AC Power for
Business-Critical Continuity™

Liebert® NXC from 10 to 20kVA

User Manual

EMERSON
Network Power

Liebert NXC 10/15/20kVA

UNINTERRUPTIBLE POWER SUPPLY

USER MANUAL

10H52188UM60 - rev. 2

All rights, including rights of translation, reproduction by printing, copying or similar methods, even of parts, are reserved.
Offenders will be liable for damages.
All rights, including rights created by patent grant or registration of utility model or design, are reserved.
Delivery subject to availability. Right of technical modification reserved.

Liebert NXC may differ from the one displayed on the front cover.

Contents

CHAPTER 1 PRODUCT INTRODUCTION 5
1.1 Features 5
1.2 Model Configurations 5
1.3 Appearance And Components 6
1.3.1 Appearance 6
1.3.2 Components 6
1.3.3 UPS device rear 8
1.4 Operating Principle 9
1.5 UPS State And Operation Mode 10
1.5.1 Normal Mode 11
1.5.2 Bypass Mode 11
1.5.3 Battery Mode 11
1.5.4 ECO Mode (For Single UPS System Only) 11
1.5.5 FRC (Frequency Converter) Mode 11
1.5.6 Fault State 11
1.5.7 Maintenance Bypass Mode 12
CHAPTER 2 BATTERY 13
2.1 Brief Introduction 13
2.2 Safety 13
2.3 Battery Power Cable 14
2.3.1 Overview 14
2.3.2 Installing the Batteries 14
2.3.3 Connecting the Batteries 15
2.4 Battery Maintenance 18
2.5 Battery Recycling 18
CHAPTER 3 SINGLE UPS INSTALLATION AND COMMISSIONING 19
3.1 Unpacking Inspection 19
3.2 Installation Preparation 19
3.2.1 Location 20
3.2.2 Environmental Requirement 20
3.2.3 Installation Tools 21
3.3 External protection devices 22
3.3.1 Rectifier And Bypass Input 22
3.3.2 Battery Input (for external Battery) 24
3.4 Connecting Power Cables 24
3.4.1 Connecting I/O Cables 25
3.4.2 Connecting and Installing External Battery 30
3.5 Single UPS Commissioning 31
3.5.1 Check Before Power-On 31
3.5.2 Single UPS Parameters Setting 31
3.5.3 Normal Mode Start-Up 33
3.5.4 Battery Mode Start-Up 33
CHAPTER 4 PARALLEL UPS INSTALLATION AND COMMISSIONING 34
4.1 Features 34
4.2 Requirements 34
4.3 Connecting Power Cables 34
4.3.1 Connecting I/O Cables 34
4.3.2 Connecting Parallel Cables 36
4.3.3 Connecting external Battery Cables 37
4.4 Commissioning Parallel System 39
4.4.1 Check Before Power-On 39
4.4.2 Parallel System Parameters Setting 39
4.4.3 Power-On Commissioning For Parallel System 40
4.5 Installation And Commissioning For Double Bus System with common neutral 40
4.5.1 Introduction 40
4.5.2 Installing External Protective Device 41
4.5.3 Connecting Power Cables 41
4.5.4 Connecting LBS Cables 41

4.5.5 Setting up the Double Bus System parameters 42
CHAPTER 5 OPERATION AND DISPLAY PANEL 43
5.1 Introduction 43
5.1.1 LED Indicators 43
5.1.2 Audible Alarm (Buzzer) 43
5.1.3 Control Buttons 44
5.1.4 LCD And Menu Buttons 44
5.2 LCD Screen Types 44
5.2.1 Start Screen 44
5.2.2 Primary Screen 45
5.2.3 Default Screen 45
5.3 Detailed Description Of Menu Items 46
5.4 Prompt Window 48
5.5 UPS Alarm Message List 48
CHAPTER 6 UPS OPERATION INSTRUCTIONS 51
6.1 UPS Start-Up 51
6.2 Transfer Procedures Between Operation Modes 51
6.2.1 Transfer From Normal Mode To Battery Mode 51
6.2.2 Transfer From Inverter Mode To Bypass Mode 51
6.2.3 Transfer From Bypass Mode To Inverter Mode 51
6.2.4 Transfer From Inverter Mode To Maintenance Bypass Mode 51
6.2.5 Transfer From Maintenance Bypass Mode To Inverter Mode 52
6.2.6 Operation with the external Maintenance Bypass in parallel systems 52
6.3 UPS Complete Shutdown 53
6.4 EPO 53
6.5 Auto Restart 53
6.6 UPS Reset 54
6.7 Language Selection 54
6.8 Changing Current Date And Time 54
6.9 Control Password 54
CHAPTER 7 COMMUNICATION 55
7.1 Installing Intellislot cards 55
7.1.1 Intellislot card Port 55
7.2 Connection cables for dry contact port and opto-coupled port 55
7.3 Connecting USB Communication Cables 57
CHAPTER 8 MAINTENANCE 58
8.1 Fan Maintenance 58
8.2 Battery Maintenance 58
8.3 Cleaning UPS 59
8.4 Checking UPS State 59
8.5 Checking UPS Functions 59
CHAPTER 9 PRODUCT SPECIFICATIONS 60
9.1 Conformity and Standards 60
9.2 Environmental Characteristics 60
9.3 Mechanical Characteristics 60
9.4 Electrical Characteristics (Input Rectifier) 61
9.5 Electrical Characteristics (Intermediate DC Circuit) 61
9.6 Electrical Characteristics (Inverter Output) 62
9.7 Electrical Characteristics (Bypass Input) 62
9.8 Efficiency, Heat Losses and Air Exchange 63
CHAPTER 10 OPTIONS 64
10.1 Option list 64
10.2 Communication Cables 64
10.3 Battery Cabinet 64
10.4 Liebert NXC Input Transformer Version 65
10.5 Liebert NXC Output Transformer Version 65
APPENDIX 1 ABBREVIATIONS 66
APPENDIX 2 INFORMATION FOR THE PROTECTION OF THE ENVIRONMENT 67

Chapter 1 Product Introduction

Liebert NXC UPS (UPS for short) is an intelligent online UPS system with sine wave output developed by Emerson Network Power. The UPS offers reliable and high quality AC power to the precision instrument.

The UPS is suitable for supplying AC power to small scale computer centers, networks, communication systems, automatic control systems and precision instruments.

This chapter introduces the features, model configurations, appearance and components, operating principle, UPS state and operation mode, and specifications of the UPS.

1.1 Features

The UPS features include:

- Compatible with two modes: 3-phase and single-phase outputs. The system wiring must be checked and the panel setting must be conducted manually
- Up to 4 units maybe connected in parallel, in order to form a n+1 redundant parallel system
- High-frequency, double conversion topology, with high input power factor, wide input voltage range, and output immunity to grid interference, thus suitable for use in areas with unstable mains supply
- High power density
- Full digital control technology based on digital signal processor (DSP) to achieve high system reliability with self-protection and fault diagnosis functions
- Intelligent battery management to extend the battery life
- Operation and display panel with both LCD and LED indication to help you learn about the system operating state and operating parameters
- Capable of ECO power supply mode, which helps you save energy to the maximum extent
- Flexible network management with Emerson monitoring software
- Fan fault self-test and automatic recognition functions
- SNMP card option, providing network communication function
- Can be connected to multiple battery strings, in order to increase autonomy when in battery supply mode

1.2 Model Configurations

Three power ratings are available for Liebert NXC UPS: 10kVA, 15kVA and 20kVA.

The model configurations are shown in Table 1-1.

Table 1-1 Model configurations

Type	Description
LI6010... (10kVA)	For single UPS system, for 1 + 1 parallel system and above 1 + 1 parallel system, the external battery cabinet with larger capacity is recommended
LI6015... (15kVA)	
LI6020... (20kVA)	

1.3 Appearance And Components

1.3.1 Appearance

The UPS device appearance is shown in Figure 1-1.

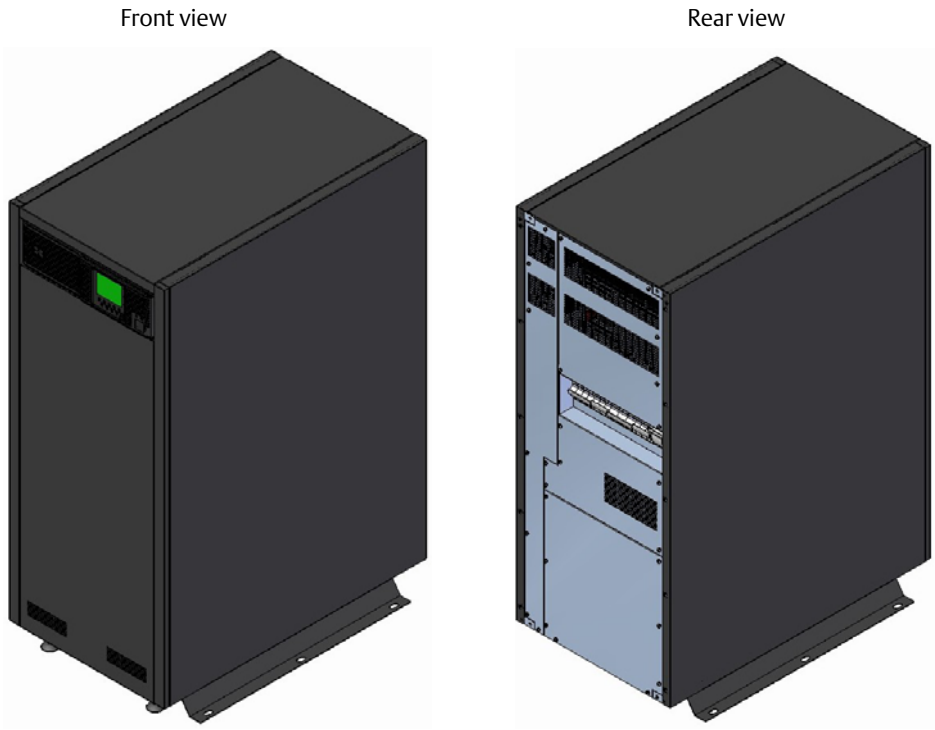


Figure 1-1 UPS appearance

1.3.2 Components

UPS module front panel

As shown in Figure 1-2, the UPS module front panel provides ventilation holes, operation and display panel, LED indicators, DIP switch and battery cold start button.

LED indicator
DIP switch and battery cold start button (with protective cover)
Ventilation hole
Operation and display panel

Figure 1-2 UPS module front panel

UPS module rear panel

As shown in Figure 1-3 and Figure 1-4, the UPS module rear panel provides parallel ports, Load Bus Synchronization (LBS) ports, Intellislot cards port, dry contact ports, opto-coupled ports, USB port and ventilation holes. The SIC-SNMP card in the Intellislot cards port is optional, it is sold separately.

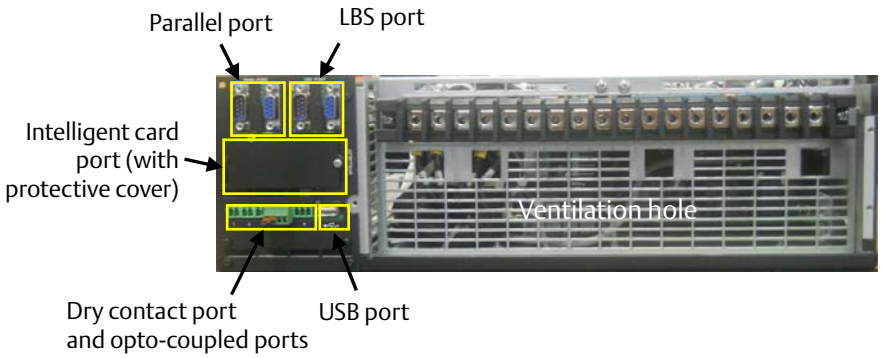


Figure 1-3 UPS module rear panel

Figure 1-4 User dry contact and opto-coupled connectors

Note
Non-authorized personnel are prohibited from opening the UPS chassis cover.

1.3.3 UPS device rear

As shown in Figure 1-5, the UPS comprises UPS module, Input/Output MCBs and I/O terminal block.

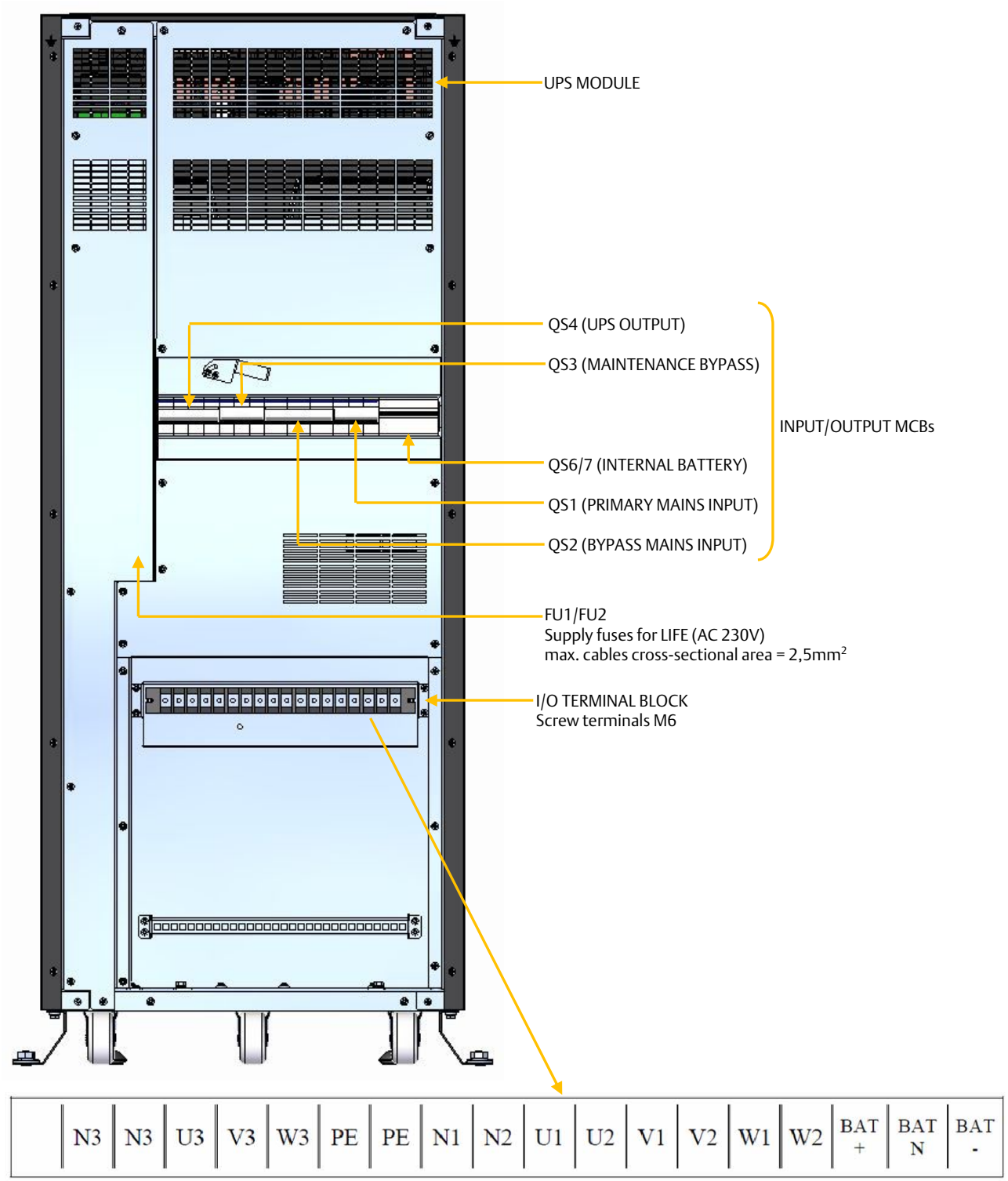

UPS MODULE
QS4 (UPS OUTPUT)
QS3 (MAINTENANCE BYPASS)
INPUT/OUTPUT MCBs
QS6/7 (INTERNAL BATTERY)
QS1 (PRIMARY MAINS INPUT)
QS2 (BYPASS MAINS INPUT)
FU1/FU2
Supply fuses for LIFE (AC 230V)
max. cables cross-sectional area = 2,5mm²
I/O TERMINAL BLOCK
Screw terminals M6
N3 N3 U3 V3 W3 PE PE N1 N2 U1 U2 V1 V2 W1 W2 BAT + BAT N BAT -

Figure 1-5 Rear view (terminal housing cover removed)

1.4 Operating Principle

The operating principle of the UPS is shown in Figure 1-6.

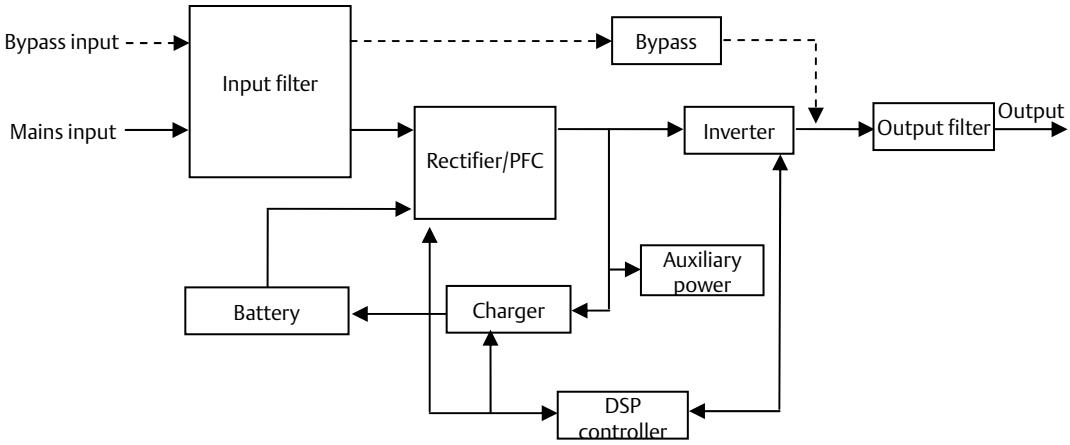


Figure 1-6 UPS operating principle

1. The UPS is composed of mains input (mains and bypass), I/O filter, rectifier/PFC, charger, inverter, bypass, battery, DSP controller, System Control Power and UPS output.

2. Under normal mains supply conditions, the rectifier switches on and the charger supplies recharge power to the battery. Before the UPS is switched on, the load is connected directly to the mains supply via the Bypass. Once the UPS has been switched on, the mains input supplies DC power to the inverter via the rectifier/PFC section. The inverter then converts DC power into pure sine wave AC power, and supplies AC power to the load through the electronic transfer switch.

3. If the mains supply is outside the normal operating limits, the rectifier/PFC circuit boosts the battery voltage and supplies it to the inverter. The inverter then converts it into pure sine wave AC power, and supplies AC power to the load through the electronic transfer switch.

4. After the mains returns to normal state, the UPS will automatically transfer from battery mode to Normal mode, the mains supplies DC power to the inverter through the rectifier/PFC circuit, and then the electronic transfer switch supplies AC power to the load.

1.5 UPS State And Operation Mode

The UPS state and operation mode include: Normal mode, Bypass mode, Battery mode, FRC (Frequency Converter) mode, ECO mode, Fault state and Maintenance Bypass mode. The operation schematic diagrams of Normal mode, Bypass mode, Battery mode, Maintenance Bypass mode, ECO mode and FRC mode are shown in Figure 1-7.

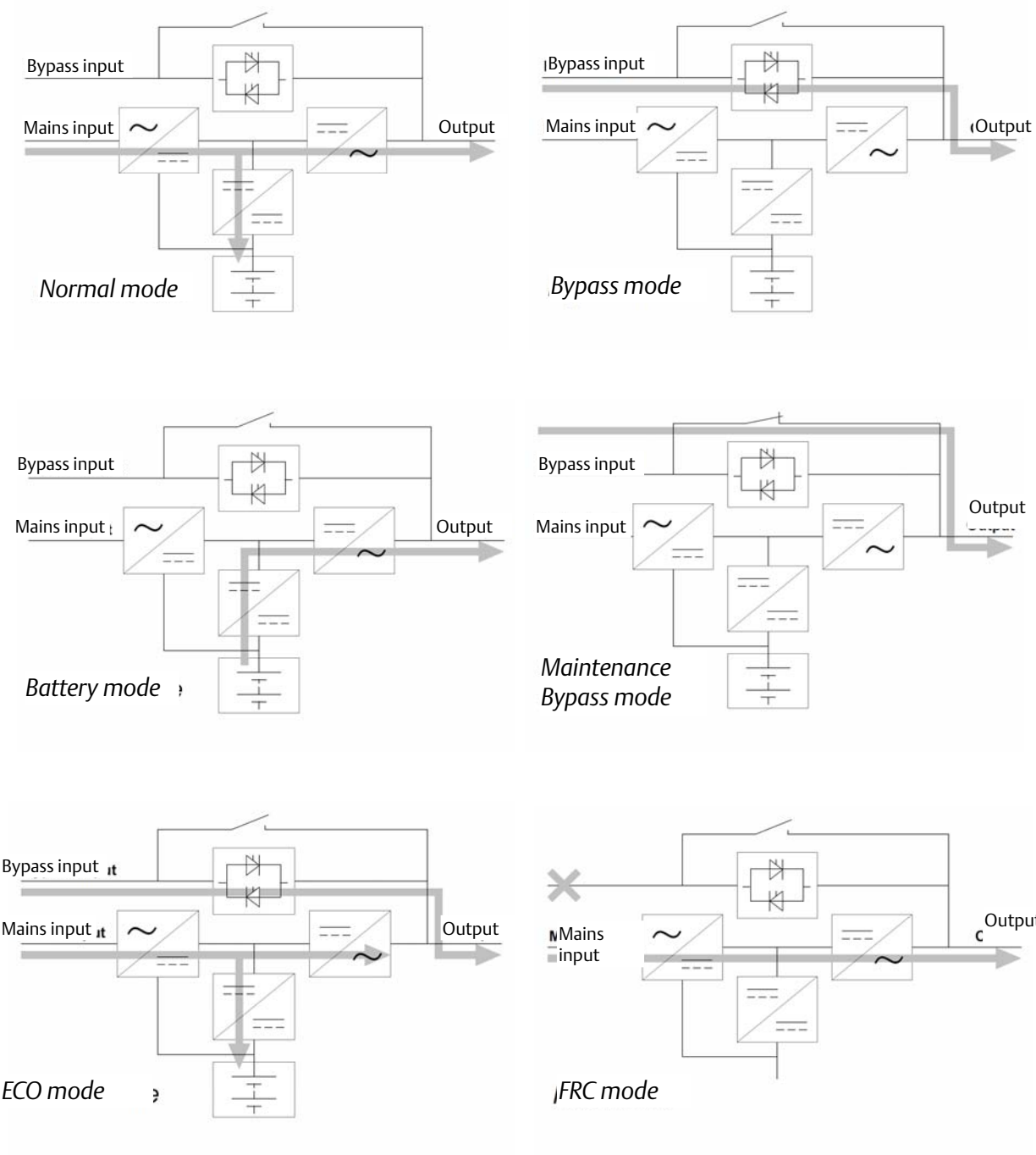


Figure 1-7 Operation schematic diagram

For the LED indicators introduced in this section, refer to 5.1.1.

1.5.1 Normal Mode

When the mains input is normal, the load is provided with voltage-stabilized and frequency- stabilized power by the inverter, and meanwhile the battery is charged.

In Normal mode, the inverter indicators are on (green).

1.5.2 Bypass Mode

If the overload time-out, inverter or rectifier failure appears during the UPS operation in Normal mode, the UPS will transfer to Bypass mode, that is, the load is powered by the bypass source, which comes directly from the mains input; if the rectifier is normal, the internal charger will charge the battery. In Bypass mode, the inverter indicators are off.

Note
In the event of mains failure or mains voltage out of range in Bypass mode, the UPS will shut down and stop the output.

1.5.3 Battery Mode

Upon mains failure, rectifier overload or mains voltage out of range, the rectifier and internal charger will become inoperative, and the battery will supply power to the load through the inverter. The inverter indicators are on together with buzzer alarming, which notifies you that the UPS is in Battery mode.

Note
1. The battery has been fully charged before delivery. However, transportation and storage will inevitably cause some capacity loss. Therefore, it is required to charge the battery for eight hours before putting the UPS into operation, so as to ensure the adequate backup time for battery. 2. The battery cold start can also be used to start the UPS from the Battery (charged) mode upon mains failure. Therefore, the battery power can be used independently for improving the system availability to some extent.

1.5.4 ECO Mode (For Single UPS System Only)

In ECO mode, the load is powered by bypass when the bypass voltage is normal, and the load is powered by inverter when the bypass voltage is abnormal. ECO mode is an energy-saving operation mode. For power equipment that is immune to power grid quality, you can use the ECO mode for power supply through bypass to reduce the power loss.

Note
1. In ECO mode, if the bypass failure or abnormal bypass voltage appears when the output is not overloaded, the UPS will transfer to Normal mode. However, if the bypass failure or abnormal bypass voltage appears when the output is overloaded, the UPS will not transfer to Normal mode, but shut down the bypass. 2. In ECO mode, the efficiency of the UPS is up to 98%.

1.5.5 FRC (Frequency Converter) Mode

This mode can be used for mains and load with different frequencies (60/50Hz or 50/60Hz).

1.5.6 Fault State

In Normal mode, the UPS will transfer to Bypass mode in the event of an inverter failure or UPS overtemperature. In Battery mode (with no bypass mains), the UPS will shut down and interrupt the supply of energy to the load in the event of an inverter failure or UPS overtemperature. In the Fault state, the fault indicators will turn on, the buzzer will keep beeping, and the corresponding fault information will be displayed on the LCD.

1.5.7 Maintenance Bypass Mode

If the maintenance and repair for UPS is needed, you can switch the load to the Maintenance Bypass through maintenance bypass MCB (Miniature Circuit Breaker), and the power to the load is uninterrupted. The maintenance bypass Miniature Circuit Breaker is located on the rear panel of the UPS device, and the capacity meets the requirements of total load capacities.

Note
If the UPS has a malfunctions and can not work normally, please get in touch with the nearest Emerson branch office or local service center. It is prohibited to repaire by yourself, as the personnel injury and damage to the equipment may occur.

Chapter 2 Battery

This chapter provides relevant information about the battery, including a short introduction, and information on battery safety, battery power cables, battery maintenance and recycling.

2.1 Brief Introduction

The UPS battery string consists of batteries connected in series in order to supply the rated DC input voltage for the UPS inverter. The battery backup time (that is, the time that the battery can continue to supply the load for when the mains supply is interrupted) depends on load level and the ampere-hour capacity of the batteries. Therefore, it may be necessary to connect several battery strings in parallel.

The NXC UPS includes a battery compartment that can accommodate the internal batteries.

In the case of UPS configurations without internal batteries, the unit must be connected to an external battery cabinet. The external battery is fitted with a protective device that can be used to isolate the battery in the event of maintenance work. This device is mounted inside or in close proximity to the battery cabinet.

Note
1. The external battery cabinet for the UPS can hold up to 128 12 V batteries. 2. It must be possible to disconnect the battery from the UPS when carrying out maintenance or service work. The fuse holder can be switched on or off manually. 3. The requirements of the EC directives are satisfied when battery cabinets are used with original accessories. If alternative batteries are used, you must ensure that the applicable EC directives are met, and declare conformity.

2.2 Safety

Take special care when working with the batteries associated with the UPS. When all the blocks are connected together, the battery string voltage can be up to 460 Vdc. This is potentially lethal. Please follow the precautions for high voltage operation. Only qualified personnel are allowed to install and maintain the battery. To ensure safety, the external batteries are to be installed inside a lockable cabinet or in a purpose-designed, dedicated battery room, so that they are only accessible to qualified maintenance personnel.

During battery maintenance, pay attention to the following items:

- Ensure that the UPS is in maintenance mode.
- The battery block number setting in the background software must be consistent with the actual battery block number.
- The battery complete Ah setting must be done in the background software.
- If the battery fuses are blown, the UPS must be repaired by authorized service personnel. The fuses must be replaced using the same type as those that were delivered with the UPS and must be supplied by the same manufacturer.

Note
Full safety instructions concerning the use and maintenance of UPS batteries are provided in the appropriate battery manufacturers' manuals. The battery safety information contained in this section relates to key considerations that must be taken into account during the installation design process and might affect the design outcome depending on localized conditions.

Warning: Hazardous battery voltage present behind covers

1. No user-serviceable parts are located behind covers that require a tool for their removal. Only qualified service personnel are authorized to remove such covers.
2. Before working on the copper bars connected to the external battery, please ensure they are disconnected from all power supplies.
3. Observe the following safety precautions when working on the batteries:
1) The battery must be firmly and reliably connected. After the connection is completed, all connections between the terminals and the batteries must be calibrated. The requirements for torque specified in the instructions or user manual provided by the battery manufacturer must be satisfied. All connections between the terminals and the batteries must be inspected and tightened at least once a year. Failure to observe this may result in fire!
2) Inspect the battery appearance before accepting and using the battery. If there is any damage to the packaging, dirty battery terminals, terminal erosion, rust, or cracks in the enclosures, deformation or electrolyte leakage, replace it with a new product. Failure to do so may result in battery capacity reduction, electrolyte leakage, or fire.
3) Batteries are very heavy. Please use the proper method when moving and lifting batteries to prevent any injuries or damage to the battery terminals. Severely damaged batteries may catch fire.
4) The battery terminals must not be subject to any force, such as the pulling force or twisting force exerted by cables. This may damage the internal connection of the battery and severe damage may result in fires.
5) The battery must be installed and stored in a clean, cool, and dry environment. Do not install the battery in a sealed battery chamber or a sealed room. The battery room ventilation must comply with EN50272-2001 as a minimum requirement. Failure to follow this instruction may result in battery bulging, fire, or even injuries.
6) The battery must be kept away from heat sources such as transformers or fire sources. Do not burn the battery or set the battery on fire, as this may result in electrolyte leakage, battery bulge, fire, or explosion.
7) Do not connect any conductor directly between the positive and negative terminals of the batteries. Remove rings, watches, necklaces, bracelets, and other metal objects before working on the batteries and ensure that the tools (for example, wrenches) are insulated. Failure to do so may result in battery burning, explosion, human death or injury.
8) Do not dismantle, modify, or damage the battery. This may result in a battery short circuit, electrolyte leakage, or even injury.
9) Clean the battery enclosure with a damp cloth. To avoid any static or arcing, do not use dry cloths or dusters to clean the battery. Do not use organic solvent, such as thinner, gasoline, or volatile oil, as this may crack the battery enclosure. In the worst case scenario, this may result in a fire.
10) The battery contains diluted sulfuric acid. In normal use, the diluted sulfuric acid is absorbed by battery the baffle and pole plates. However, if the battery is damaged, the acid may leak from the battery. Therefore, use personal protective equipment such as goggles, rubber gloves, and an apron when working on the battery. The diluted sulfuric acid may cause blindness if it enters the eyes and burns if it comes into contact with the skin.
11) The battery will be affected by shorting, electrolyte dry-up, or positive-pole plate erosion at the end of its life. If it is still used in this state, thermal runaway, bulging, or electrolyte leakage may occur. Please replace the battery before it reaches this state.
12) Before connecting or disconnecting the battery connection cables, please isolate the charging power.
13) Check if the battery has been unexpectedly earthed. If this is the case, remove the earth connection. Contact with any part of the earthed battery may result in an electric shock.

2.3 Battery Power Cable

2.3.1 Overview

Please install and connect the batteries according to the following description and graphic representation.

2.3.2 Installing the Batteries

1. Before installation, check the batteries for signs of damage, inspect and count the accessories, and carefully read this manual and the user manual or installation instructions provided by the battery manufacturer.

2. There must be a clearance of 10 mm between the vertical sides of the batteries to allow for the flow of air around the batteries.

3. A sufficient amount of clearance must be maintained between the battery top and the underside of the layer above it to facilitate battery monitoring and maintenance.

4. The batteries must be installed from the bottom layer upwards to avoid creating a high center of gravity. The battery must be installed properly and protected from vibrations or shock.

5. An isolating device shall be fitted as close as possible to the battery in accordance with the local installation requirements.

6. In the case of a parallel UPS system that uses a common battery bank, an additional isolating device (switch) must be installed in the dedicated common battery connection to each individual UPS, so that system maintenance can be carried out correctly. In any event, we advise against using common battery solutions as they reduce the reliability of the system.

7. Measure the battery voltage and calibrate the battery voltage after starting up the UPS.

2.3.3 Connecting the Batteries

1. Check that the battery fuses are not inserted. These must be fitted during commissioning, NOT during installation.

2. If the battery cabinet is installed on a raised floor or side by side with the UPS on a solid floor, the battery power cables and other cables can enter the UPS cabinet through the base of the cabinet. The cables for connecting the UPS to the battery cabinets are not included in the delivery. They can be provided by the manufacturer upon request. For the best interference suppression (to reach class C2 EM) we recommend using shielded battery cables between the UPS cabinet and the battery cabinet. The shielding must be connected to both the UPS and the battery cabinets.

3. Make the ground connections (PE).

4. When multiple battery strings are used, they must be connected in series and then in parallel. Before applying load and commencing power-up, be sure to measure the total voltage of the battery strings and make sure that it is correct. The negative and positive terminals of the battery must be connected to the corresponding negative and positive battery terminals of the UPS, in accordance with the labels on the battery and the UPS. Reverse battery connection may result in explosion, fire, damage to the battery, damage to the UPS, or personal injury.

5. After connecting the battery cables, install an insulating shroud for each terminal.

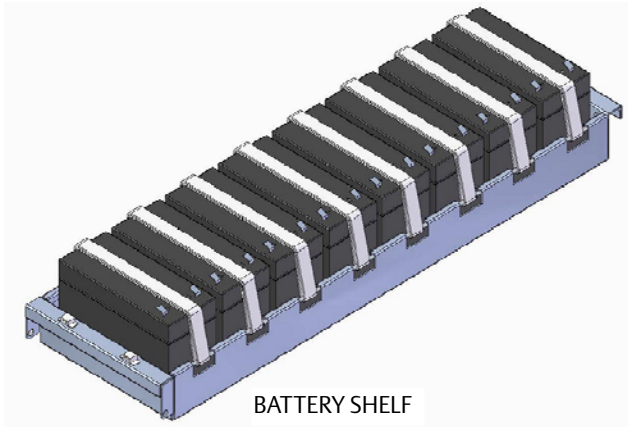
6. The bending radius of the cable is to be larger than 10D, where D is the outer diameter of the cable.

7. After connecting the cables, do not pull on the battery cables or the cable terminals.

8. Do not cross the battery cables during connection and do not tie the battery cables together.

9. To connect the cables for the internal batteries, refer to Figure 2-1 and Figure 2-2. To connect the cables for the external batteries, refer to the "Battery Installation Manual".

ARRANGE THE BATTERIES AND CONNECT THEM AS ILLUSTRATED IN Figure 2-1.



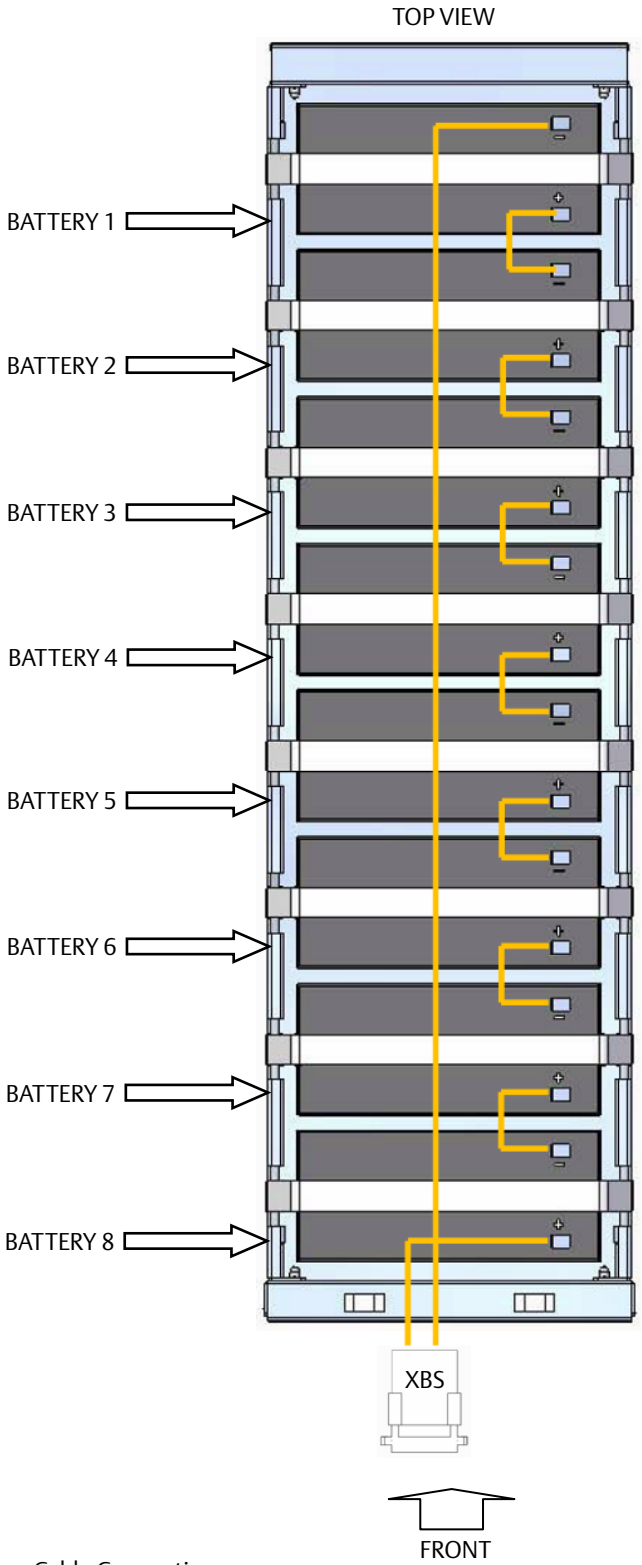


Figure 2-1 Internal Battery Cable Connection

CONNECT THE BATTERY CABLES AS ILLUSTRATED IN Figure 2-2.

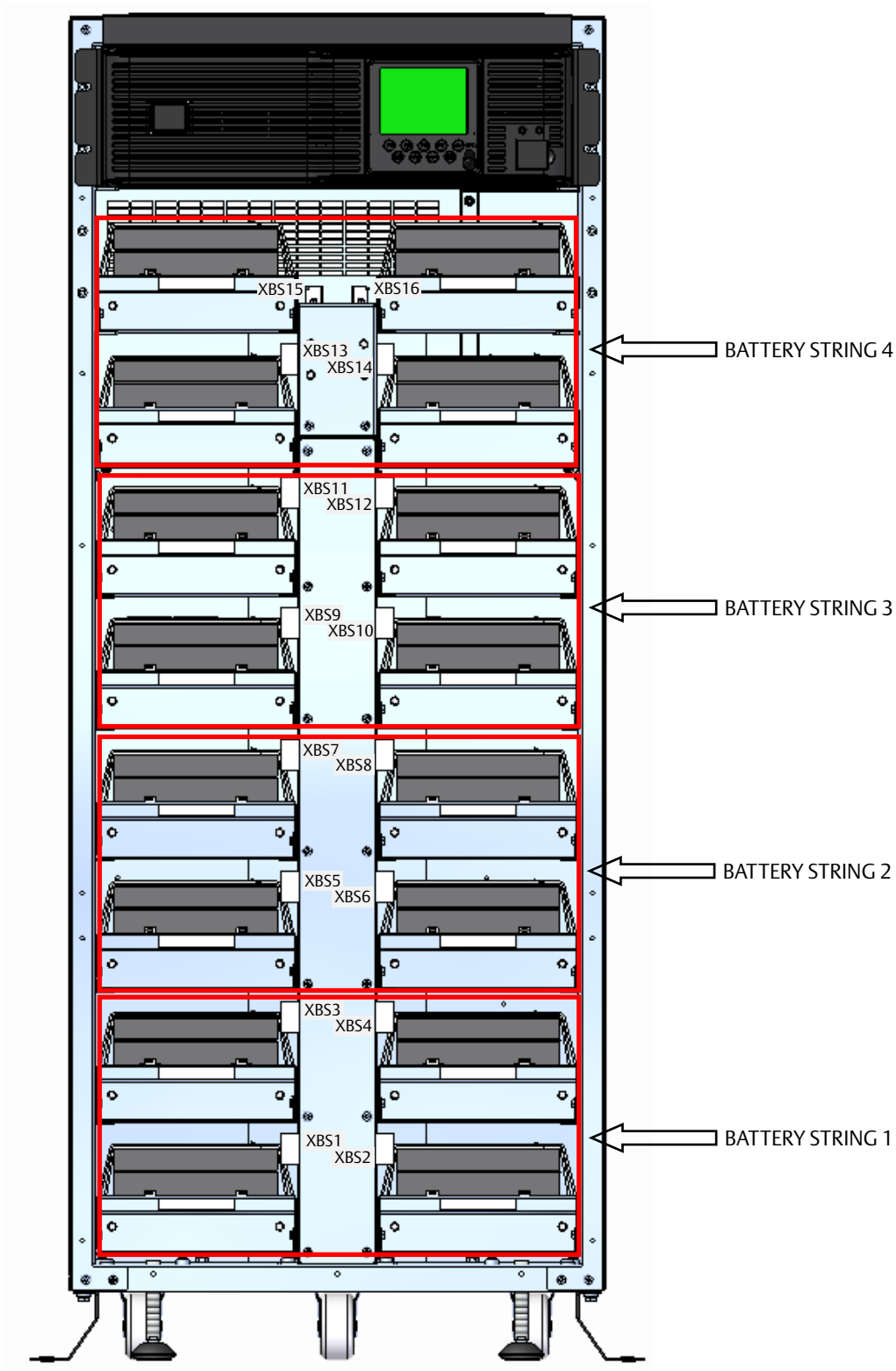


Figure 2-2 Internal Battery Cable Connection

For safety reasons, a female connector has been inserted on male connector of battery shelf; disconnect the female connector in order to connect the XBS... male connector of the battery shelf to the female connector on the UPS.

N.B. The 3rd and 4th strings may also be installed in the field, during the initial installation.

2.4 Battery Maintenance

For battery maintenance and maintenance precautions, refer to IEEE-Std-1188-2005 and the relevant manuals provided by the battery manufacturer.

Note
1. Check that all safety devices are present and that they function correctly. Check that the battery management parameters are set correctly. 2. Measure and record the air temperature inside the battery room. 3. Check the battery terminals for damage and heating and ensure that there is no evidence of corrosion. Check the battery enclosure and terminal covers for damage.

2.5 Battery Recycling

If the battery leaks electrolyte, or is otherwise physically damaged, it should be placed in a container resistant to sulphuric acid and disposed of in accordance with local regulations.

Disused lead-acid storage batteries are classified as dangerous waste and are critical elements in disused battery pollution control. Storage, transportation, use, and disposal of batteries must comply with the national and local laws and regulations on dangerous waste, disused battery pollution prevention, and other standards.

In accordance with the relevant national regulations, disused lead-acid storage batteries must be recycled and must not be disposed of by other methods. Illegal dumping or any other improper disposal of disused lead-acid storage batteries may cause severe environmental pollution and those responsible may be liable for prosecution.

As a lead-acid storage battery supplier, Emerson has created an excellent service network and disused battery recycling system to help customers dispose of lead-acid storage batteries legally and properly. For detailed information about Emerson's disused battery recycling system, please consult the local customer service center or Emerson sales office. If the customer disregards these instructions or does not use Emerson's disused battery recycling system, Emerson cannot be held responsible for any environmental consequences of the failure to dispose of disused battery products correctly.

Chapter 3 Single UPS Installation And Commissioning

This chapter describes the installation, cable connection and commissioning of the single UPS.

Each site has its peculiarity, so this chapter provides the guidance with general installation procedures and methods for the installation engineer, who should conduct the installation according to the actual conditions.

Warning: professional installation
The UPS should be installed by a qualified engineer according to the information contained in this chapter. If any problem is found, please get in touch with Emerson local service center immediately. The UPS shall not be powered on without approval of the commissioning engineer. For other equipments which are not introduced in this manual, the detailed information about mechanical installation and electrical installation are delivered with the equipment.

Note: 3-phase 5-line for power input
The UPS can be connected to 3-phase 5-line (L1, L2, L3, N, PE) TN and TT AC power distribution system (IEC/EN 60364-3).

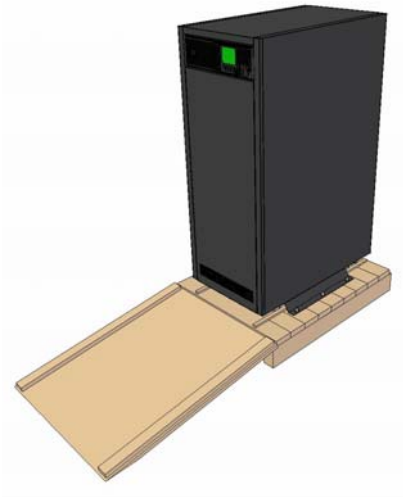
3.1 Unpacking Inspection

After the UPS arrival, you should unpack it and check the following items:

1. Visually inspect the UPS appearance for transportation damage. If any problem is found, please notify the carrier immediately.

2. Check the accessories and models against the below delivery list. If any problem is found, please notify the dealer immediately.

- Safety manual
- User manual
- Test bulletin
- Insulating material (28010935)
- Copper busbar kit (21500904)
- 1x connector 3 PIN pitch 3,81mm (14120115)
- 3x connector 2 PIN pitch 3,81mm (14120116)
- 7x lugs (1417230))



3.2 Installation Preparation

Prior to transportation, make sure of the height of any doors are sufficient and there not other obstacles standing in the passage of the UPS. Refer to the following for dismantling of machine cabinet.

- Remove outer packaging and side supporting plates first.
- Place dismantled wooden cover in front of the pallet, and then fix the wooden cover to the pallet with the hook provided, so as to form a ramp, push UPS down the ramp.
- Routine maintenance operations may involve removal of front and rear panels. Space must be provided to permit the unit to be rolled back and forward.
- Always install the Stabilizing Brackets to enhance the stabilizing of the UPS. If the UPS needs to be moved after Stabilizing Brackets have been attached, the Brackets must be removed.
- To remove the Stabilizing Brackets, unscrew all the nuts and bolts holding it in place and slide it out from under the UPS.
- When the UPS has reached its new position, push the Brackets into its down position again, and tighten the screws.

● Brake Pad: with 19mm wrench in clockwise direction to screw the Brake Pads down to the ground, to prevent the UPS moving.

3.2.1 Location

To extend the UPS life, the place chosen must offer:

- The UPS must be installed vertically, on a level and even surface
- Convenient wiring
- Adequate operator access area
- Adequate ventilation to meet the heat dissipation requirement
- No corrosive gas, such as sulfur dioxide and so on
- No excessive moisture or heat source
- No excessive dust
- Compliance with fire-fighting requirements
- Operating temperature compliant with the specifications, see Table 9-2 for details

3.2.2 Environmental Requirement

UPS room

The UPS is designed for indoor installation, which should be installed in a clean and well-ventilated environment, so as to keep the ambient temperature within the specifications.

The internal fans provide the forced air cooling for the UPS. Cooling air enters the UPS through the ventilation holes on the front panel, and exhausts the hot air through the back ventilation holes. Therefore, do not obstruct the ventilation holes. Maintain at least 200mm clearances between the front, rear, side panels of the UPS and the wall or adjacent equipment (see Figure 3-1), so as not to obstruct the UPS ventilation and heat dissipation. Otherwise, the UPS internal temperature will rise, which will shorten the UPS life.

Note: for exchanging the UPS Power Module or the Battery Tray a front clearance of 950mm is necessary.

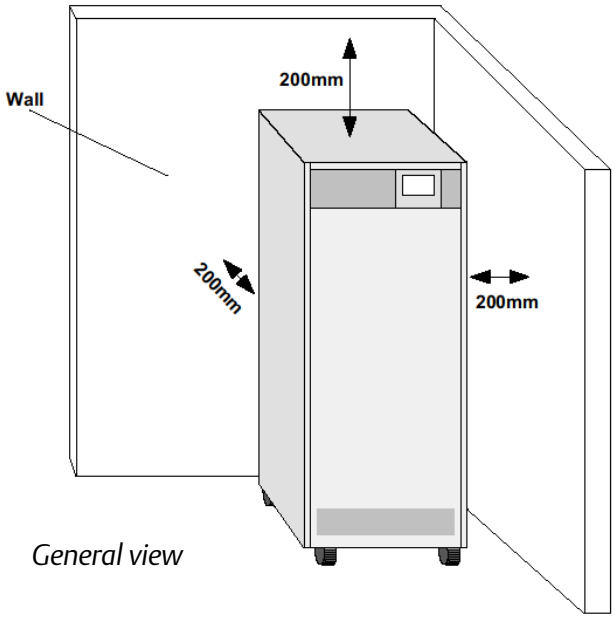


Figure 3-1 Installation clearances

Note
The UPS should be installed only on the concrete surface or other non-flammable surfaces.

UPS room (when Battery is integrated)

A small amount of hydrogen and oxygen will be generated at the end of battery charging, therefore, you must ensure that the fresh air ventilation of battery installation environment meets the EN50272-2001 requirements.

The battery ambient temperature should be the constant temperature, for the ambient temperature is the main factor to affect the battery capacity and life. The battery standard operating temperature is 20°C, operation above this temperature will shorten the battery life, and operation below this temperature will reduce the battery capacity. If the battery average temperature in operation rises from 20°C to 30°C, the battery life will be reduced by 50%; if the battery temperature in operation exceeds 40°C, the battery life will be decreased exponentially. In general, the ideal ambient temperature of the battery is 15°C ~ 25°C. The battery should be kept away from heat and ventilation holes.

When the UPS uses an external battery, you must install a battery protective device (such as fuse or circuit breaker) near to the battery, and use the shortest wiring distance between the protective device and battery connection.

Storage

If the UPS and/or battery is to be stored for any length of time before being installed, it must be kept indoors, in a cool, dry, well ventilated environment. The ideal battery storage temperature is between 20 and 25°C.

Warning: battery hazards
During the battery storage, the battery must be periodically charged according to the battery instructions. You can connect the UPS to the mains temporarily when charging the battery, **so as to charge the battery for battery activation**.

3.2.3 Installation Tools

The tools must be insulated.

3.3 External protection devices

This device is equipped with manual switches intended only for Service Bypass and Internal Service operations. It is therefore essential that the customer install external protection devices at the installation site. These must be installed near the unit and labeled as the line power separation device for the UPS (see IEC/EN 62040-1).

Warning
The following label must be displayed on all switching devices installed in the same electrical system as the UPS, even when they are located far from the area where the system is located (according to European standard IEC/EN 62040-1):

MAKE SURE THE UNINTERRUPTIBLE POWER SYSTEM IS ISOLATED
BEFORE WORKING ON THIS CIRCUIT

Use of differential protection devices

Note: Differential Current Breakers
• The UPS does not require differential protection devices connected ahead of it. However, when these devices are installed in compliance with local regulations, note that separate DCBs in the line power and bypass line power circuits may trip unexpectedly, thus interrupting the power supply to the unit. Therefore, if a DCB must be installed, only one should be used for both primary and bypass inputs. • In parallel distributed systems, only one common differential protection device should be installed ahead of the point where the line divides into the UPS primary and bypass line power circuits. If separate DCBs are installed in different configurations, they may trip unexpectedly. • In order to guarantee correct distribution in the neutral cables, installation personnel shall make sure that the lengths of the cables are as equal as possible. However, if the bypass lines lead from sources that are electrically isolated from each other, a differential protection device may be installed on each line. In this case, and in cases when the load is supplied from the Bypass via the Static Bypass Switch, the isolated sources are connected in parallel. A case-bycase analysis should be made as to whether any resulting imbalance between the currents on the Bypass lines is compatible with the respective protection devices.

3.3.1 Rectifier And Bypass Input

Overcurrent

The appropriate overcurrent protective device should be installed at the mains input power distribution, and the current capacity of power cable and the system overload requirements should be taken into account in installation. It is recommended to use the thermo magnetic circuit breaker which satisfies with IEC/EN 60947-2 tripping curve C (normal) when the current value reaches 125% of the current value listed in Table 3-1.

Split-bypass

When the system adopts split-bypass, separate protective devices should be installed at the mains input power distribution respectively for the mains and bypass.

Bypass backfeed protection

When using the bypass backfeed protection function, it is necessary to install a protective device with auxiliary contact function upstream of the UPS bypass input; the auxiliary contact should be connected to the system opto-coupled contact port (refer to section 7.2 and Figure 3-2).

Note
The same neutral line must be used for the rectifier and bypass power.

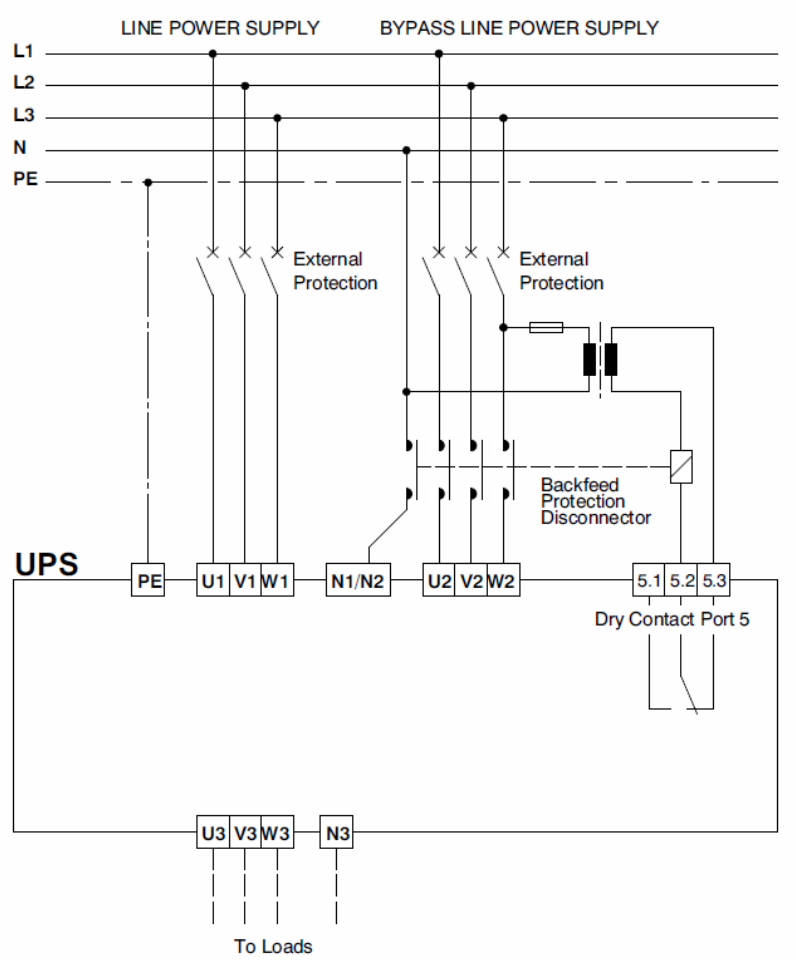


Figure 3-2 External protective device for backfeed protection

Earth leakage current

The residual current detector (RCD) for the UPS upstream input power distribution should be:

- Sensitive to the DC unidirectional pulse (level A) in power distribution network
- Insensitive to the transient current pulse

The residual current circuit breaker (RCCB) must be sensitive to the DC unidirectional pulse (level A) in power distribution network, but insensitive to the transient current pulse, as shown in Figure 3-3 respectively.

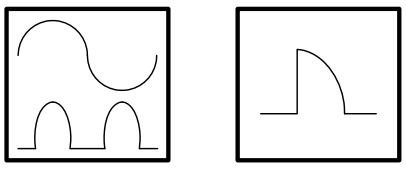


Figure 3-3 RCCB symbols

When using the earth RCD in split-bypass system or parallel system, the RCD should be installed at the upstream input power distribution terminal to avoid generating false alarms.

The earth leakage current introduced by the RFI filter in the UPS ranges from 3.5mA to 1000mA. It is recommended to confirm the sensitivity of each differential device of the upstream input power distribution and downstream power distribution (to load).

3.3.2 Battery Input (for external Battery)

The overcurrent protective device has been placed in the battery cabinet, when you choose the battery cabinet option provided by Emerson. Otherwise, the external battery cabinet should provide DC compatible fused circuit breaker, so as to provide the overcurrent protection for the UPS and its batteries.

3.4 Connecting Power Cables

I/O cables and battery cables are required for connection. When connecting the cables, you should follow the local wiring regulations, take the environmental situation into account, and refer to Table 3B of IEC/EN 60950-1. The max. current in different operating modes is listed in Table 3-1, the recommended min. cable CSA is listed in Table 3-2. Select the appropriate cables according to Table 3-1 and Table 3-2.

Table 3-1 Max. steady state AC and DC current

UPS rated power (kVA)	Rated current (A)						
	Mains input current[1,2] upon battery charging with max. ability			Gross output current[2] at full load			Battery discharging current at min. battery voltage (EOD) (30 blocks)
	380V	400V	415V	380V	400V	415V	
10 (3-in 3-out)	22	21	20	15	15	14	34
10 (3-in 1-out)	22	21	20	45	44	42	34
15 (3-in 3-out)	29	28	27	23	22	21	50
15 (3-in 1-out)	29	28	27	69	65	63	50
20 (3-in 3-out)	37	35	34	30	29	28	67
20 (3-in 1-out)	37	35	34	90	87	84	67

Note:
When selecting the battery cables, according to the current value shown in table, the max. allowable voltage drop is 4Vdc. Do not ring the cables, so as to avoid increasing the electromagnetic interference (EMI).
1: The mains current input of the rectifier and bypass.
2: Non-linear load (switch mode power) affects the neutral cable design of output and bypass. The neutral cable current may exceed the rated phase current, in general, 1.732 times as large as the rated current (not applicable, when 3-in 1-out mode)

Table 3-2 Single UPS cable CSA (unit: mm^2, ambient temperature: 25°C）

Model	Input	Output	Bypass	Neutral cable	PE	Battery
10kVA (3-in 3-out)	4	4	4	4	4	6
10kVA (3-in 1-out)	4	10	10	10	10	6
15kVA (3-in 3-out)	6	6	6	6	6	10
15kVA (3-in 1-out)	6	16	16	16	16	10
20kVA (3-in 3-out)	10	10	10	16	10	16
20KVA (3-in 1-out)	10	25	25	25	16	16

The recommended UPS input MCB capability is listed in Table 3-3, select the MCBs according to your requirements.

Note

The UPS is high leakage current equipment, it is not recommended to configure the MCB with leakage current protection function.

Table 3-3 UPS MCB selection

Model	Input interface	Recommended capability of input external MCB		Battery MCB	Output interface
		Main	Bypass		
10kVA (3-in 3-out)	Terminal block	32A	32A	DC 35A	Terminal block
10kVA (3-in 1-out)	Terminal block	32A	63A (1P)	DC 35A	Terminal block
15kVA (3-in 3-out)	Teminal block	40A	40A	DC 63A	Terminal block
15kVA (3-in 1-out)	Teminal block	40A	80A (1P)	DC 63A	Terminal block
20kVA (3-in 3-out)	Teminal bock	50A	50A	DC 80A	Terminal block
20kVA (3-in 1-out)	Teminal block	50A	100A (1P)	DC 80A	Terminal block

Note:
The 3-in 1-out MCB (125A) is used to connect the bypass input upon split-bypass configuration. The main MCB (63A) can be used only upon common source configuration

3.4.1 Connecting I/O Cables

The power cables of the UPS should be connected through the I/O terminal block located on the UPS rear panel. Figure 3-4 gives the terminal layout of the I/O terminal block.

3-in 3-out: max. cable cross-sectional area = 16mm^2

3-in 1-out: with copper shorting bars n. 4, 5, 7, 8, 10 = max. 25mm^2

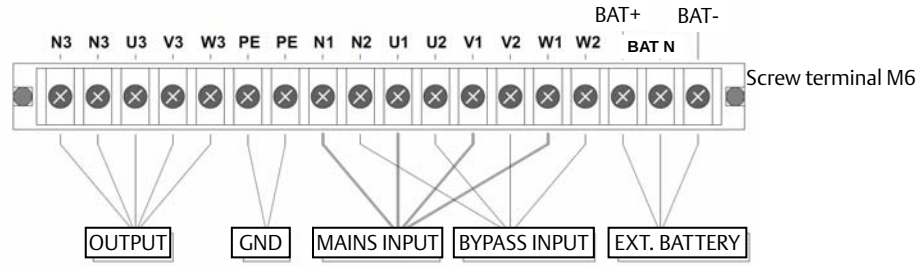


Figure 3-4 Terminals layout of the I/O terminal block

Power distribution mode

According to the user's requirements, the I/O cable connections can be configured into four types:

- 3-in 3-out, common source configuration (factory default),
- 3-in 3-out, split-bypass configuration,
- 3-in 1-out, common source configuration,
- 3-in 1-out, split-bypass configuration.

Self-distribution

The four I/O cable connection procedures of the self-distribution are as follows:

● 3-in 3-out, common source configuration (factory default)

1. Connect the live lines (input phase L1, input phase L2 and input phase L3), N line and PE line respectively to the I/O terminal block (U1, V1, W1 and N1 and PE terminals) of the UPS.

Short connect U1 and U2, V1 and V2, W1 and W2 of the UPS I/O terminal block using the copper shorting bar 3 respectively (factory default).

2. Connect the live lines (output phase L1, output phase L2 and output phase L3), N line and PE line respectively to the I/O terminal block (U3, V3, W3 and N3 and PE terminals) of the UPS, as shown in Figure 3-5.

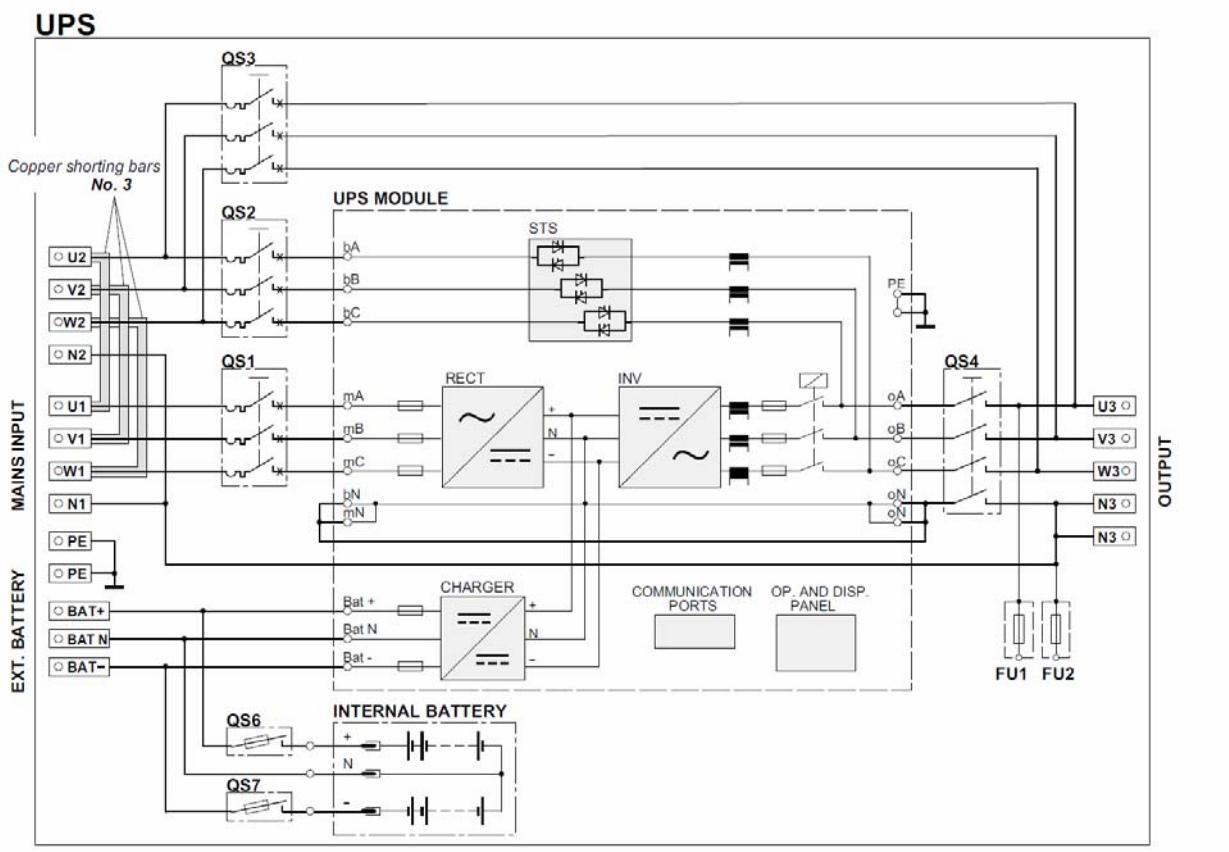


Figure 3-5 3-in 3-out, common source configuration cable connection

- 3-in 3-out, split-bypass configuration

1. Remove all the copper shorting bars 3 from the UPS I/O terminal block.

2. Connect the live lines (mains input phase L1, mains input phase L2 and mains input phase L3), N line and PE line respectively to the I/O terminal block (U1, V1, W1 and N1 and PE terminals) of the UPS.

3. Connect the live lines (bypass input phase L1, bypass input phase L2 and bypass input phase L3) and N line respectively to the I/O terminal block (U2, V2, W2 and N2 terminals) of the UPS.

4. Connect the live lines (output phase L1, output phase L2 and output phase L3), N line and PE line respectively to the I/O terminal block (U3, V3, W3 and N3 terminals and PE terminal) of the UPS.

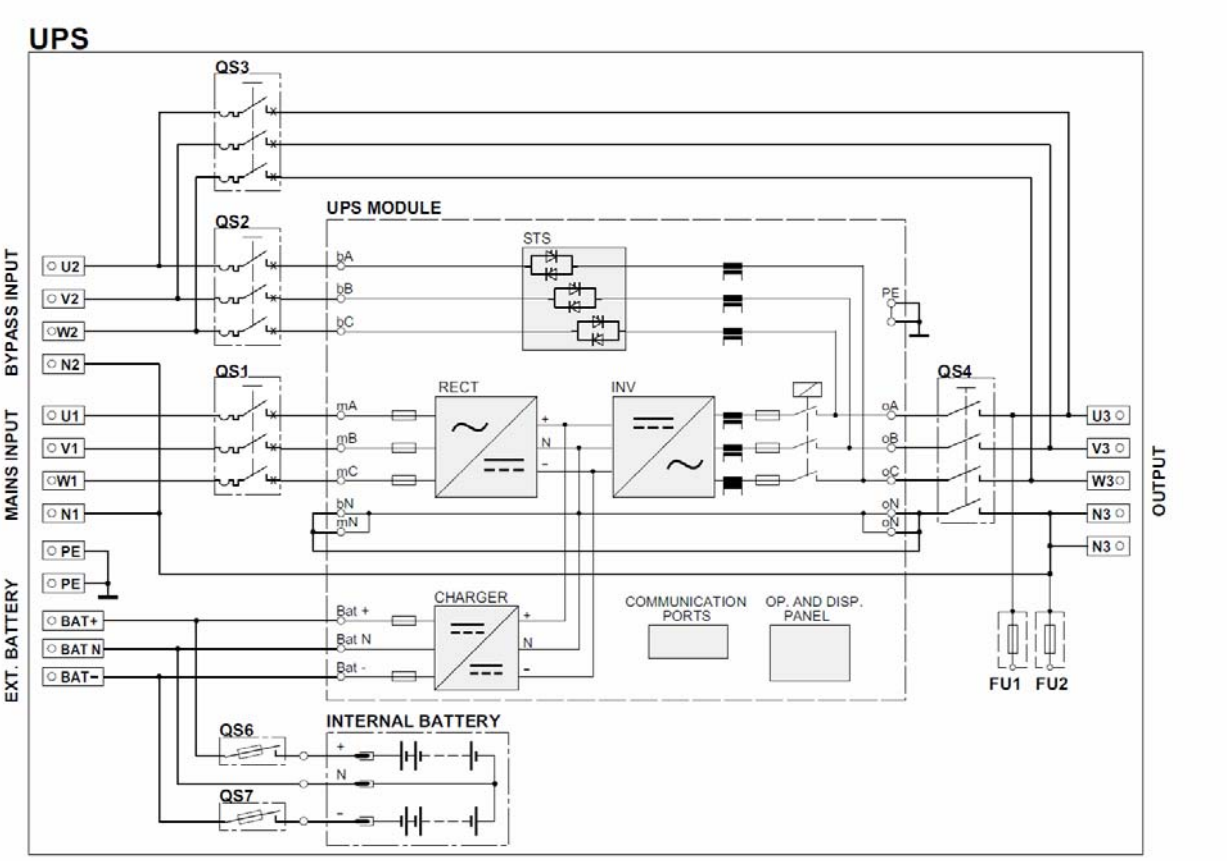


Figure 3-6 3-in 3-out, split-bypass configuration cable connection

- 3-in 1-out, common source configuration

Warning
The factory default of this UPS is 3-in 3-out, common source configuration. Change the power distribution mode of the UPS to 3-in 1-out according to the steps described in the following section Changing power distribution mode. Continue the following input and output power cable connection and power-on commissioning after confirming that the change has been successful.

1. Confirm that the power distribution mode of the main UPS has been changed to 3-in 1-out according to the steps described in the following section Changing power distribution mode.

2. As shown in Figure 3-7, attach the self-adhesive insulating film (accessory) on the copper shorting bar 10, and insert the buckles into the corresponding holes on the copper shorting bar 10.

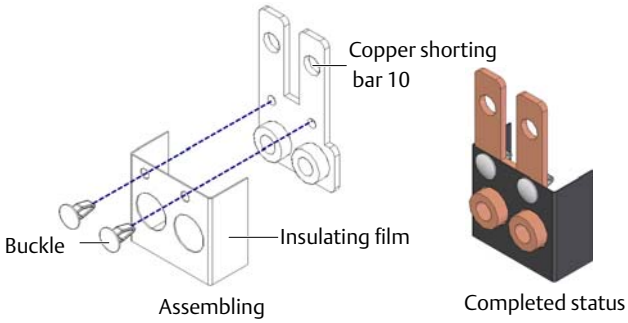


Figure 3-7 Attaching the insulating film to the copper shorting bar 10

3. As shown in Figure 3-8, short connect U2, V2 and W2 terminals using the copper shorting bar 7, short connect the PE terminals of the I/O terminal block of the UPS using the copper shorting bar 10 with insulating film, short connect U3, V3 and W3 terminals using the copper shorting bar 5, short connect U1 and U2 terminals using the copper shorting bar 6, short connect N1 and N2 terminals, and two N3 terminals using the two copper shorting bar 4.

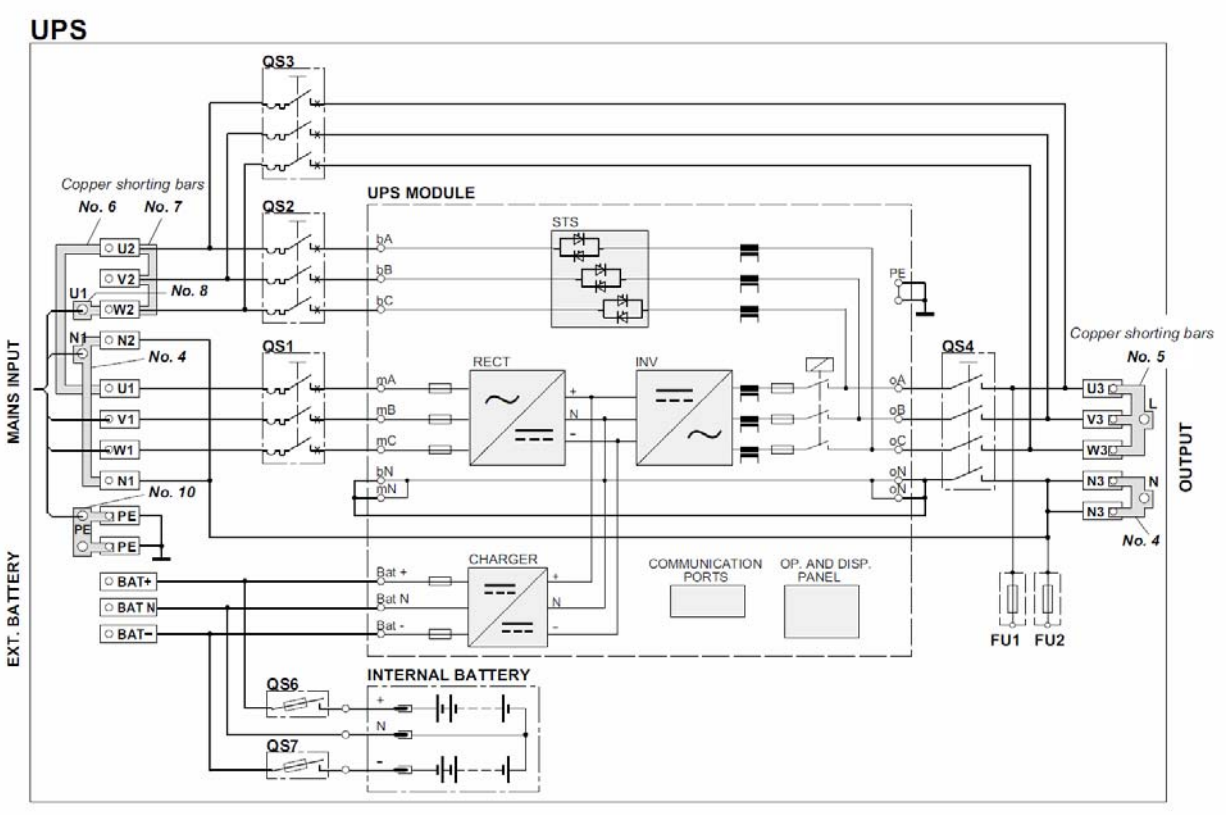


Figure 3-8 3-in 1-out, common source configuration cable connection

4. Connect the copper shorting bar 8 to one end of the copper shorting bar 7 (see Figure 3-8), and connect the live line (input phase L1) to the copper shorting bar 8.

5. Connect the live lines (input phase L2 and input phase L3), N line and PE line respectively to the I/O terminal block (V1 and W1 terminals) of the UPS, one screw hole of the copper shorting bar 4 with N1 and N2 terminals, and one screw hole of the copper shorting bar 10.

6. Connect the output L line, N line and PE line respectively to the copper shorting bar 5, copper shorting bar 4 with two N3 terminals, and the other screw hole of the copper shorting bar 10.

- 3-in 1-out, split-bypass configuration

Warning
The factory default of this product is 3-in 3-out, common source configuration. Change the power distribution mode of the main UPS to 3-in 1-out according to the steps described in the following section Changing power distribution mode. Continue the following input and output power cable connection and power-on commissioning after confirming that the change has been successful.

1. Confirm that the power distribution mode of the main UPS has been changed to 3-in 1-out according to the steps described in the following section Changing power distribution mode.

2. As shown in Figure 3-7, attach the self-adhesive insulating film (accessory) on the copper shorting bar 10, and insert the buckles into the corresponding holes on the copper shorting bar 10.

3. As shown in Figure 3-9, short connect the two PE terminals of the I/O terminal block of the UPS using the copper shorting bar 10 with insulating film, short connect U2, V2 and W2 terminals using the copper shorting bar 7, short connect U3, V3 and W3 terminals using the copper shorting bar 5, short connect N1 and N2 terminals, and two N3 terminals using the two copper shorting bar 4.

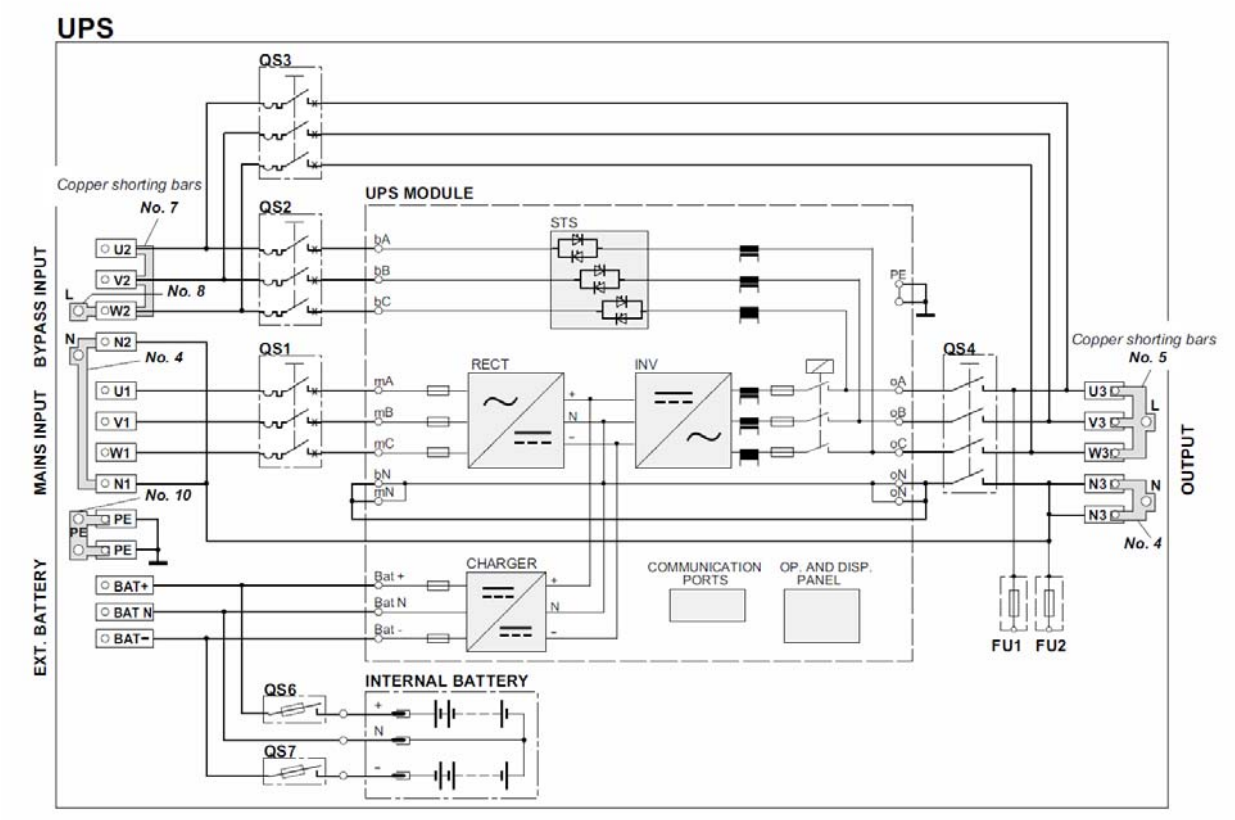


Figure 3-9 3-in 1-out, split-bypass configuration cable connection

4. Connect the live lines (input phase L1, L2 and input phase L3), N line and PE line respectively to the I/O terminal block (U1, V1 and W1 terminals) of the UPS, one screw hole of the copper shorting bar 4 with N1 and N2 terminals, and one screw hole of the copper shorting bar 10.

5. Connect the copper shorting bar 8 to one end of the copper shorting bar 7 (see Figure 3-9), and connect the live line (bypass input phase L) to the copper shorting bar 8.

6. Connect the bypass input N line to the copper shorting bar 4 with N1 and N2 terminals of the UPS I/O terminal block.

7. Connect the output L line, N line and PE line respectively to the copper shorting bar 5, copper shorting bar 4 with two N3 terminals, and the other screw hole of the copper shorting bar 10 of the UPS I/O terminal block.

Warning
Before the commissioning engineer arrival, if the load is not ready for accepting the power, please take good care of the safety insulation located at the end of the output cable.

After the output cable connection, find the label shown in Figure 3-10 on the enclosure of the UPS and put a tick after “AC OUTPUT” and “BYPASS INPUT” according to the actual situation for ease of maintenance.

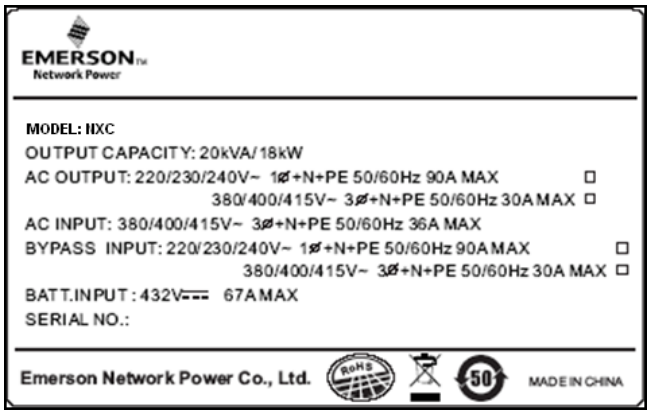

EMERSON
Network Power
MODEL: NXC
OUTPUT CAPACITY: 20kVA/18kW
AC OUTPUT: 220/230/240V~ 1Ø+N+PE 50/60Hz 90A MAX
380/400/415V~ 3Ø+N+PE 50/60Hz 30A MAX
AC INPUT: 380/400/415V~ 3Ø+N+PE 50/60Hz 36A MAX
BYPASS INPUT: 220/230/240V~ 1Ø+N+PE 50/60Hz 90A MAX
380/400/415V~ 3Ø+N+PE 50/60Hz 30A MAX
BATT.INPUT: 432V⎓ 67A MAX
SERIAL NO.:
Emerson Network Power Co., Ltd.
MADE IN CHINA

Figure 3-10 Label

Changing power distribution mode

Note
This product is compatible with 3-in 3-out/3-in 1-out, factory default: 3-in 3-out. Change the format according to the following steps if you need to change the power distribution mode.

- From 3-in 3-out to 3-in 1-out

1. Remove all the copper shorting bars 3 shown in Figure 3-5 of the 3-in 3-out system; connect the main input cables only. It is prohibited to connect the bypass input cables, output cables and battery cables at this stage, as shown in Figure 3-11.

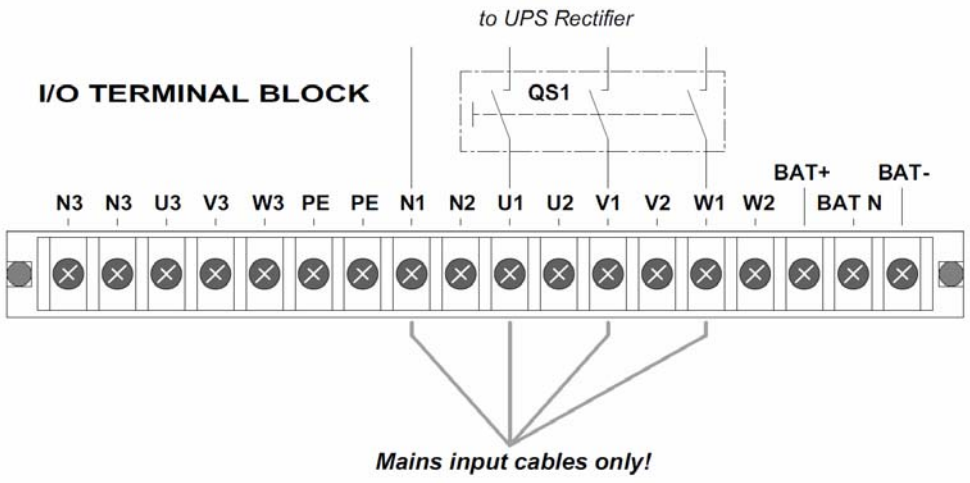


Figure 3-11 Main input

2. Remove the EPO jumpers of the dry contact port 4 (see Figure 7-2 and 0).

3. Power on the system with MCB QS1. Set the system to 'Single' through the LCD menu 'Settings' -> '3 Phase Output or 1 Phase Output' (default password: 12345), and power off the system completely, then power on the system again, enter this menu to confirm the setting is valid.

4. Power off the system completely, and replace the EPO jumpers of the dry contact port 4, and remove the main input cable.

- From 3-in 1-out, to 3-in 3-out

1. Remove all copper shorting bars shown in Figure 3-8 and Figure 3-9 of the 3-in 1-out system, connect the main input cables only. It is prohibited to connect the bypass input cables, output cables and battery cables at this stage, as shown in Figure 3-11.

2. Remove the EPO jumpers of the dry contact port 4 (see Figure 7-2 and 0).

3. Power on the system. Set the system to 'Three' through the LCD menu 'Settings' -> '3 Phase Output or 1 Phase Output' (default password: 12345), and power off the system completely, then power on the system again, enter this menu to confirm the setting is valid.

4. Power off the system completely, replace the EPO jumpers of the dry contact port 4, and remove the main input cable.

3.4.2 Connecting and Installing External Battery

Notes

For the installation and commissioning of an external Battery, refer to "Liebert NXC Battery User Manual".

3.5 Single UPS Commissioning

3.5.1 Check Before Power-On

1. Check and confirm that the power distribution mode of the UPS is correct, that the connections of the power cable and signal cable are correct and there is no short circuit.

2. When using an external Battery, check that the battery installation and the cable connections are correct, and that the connection cables are connected correctly to the positive and negative battery poles.

3. Measure and confirm that the mains voltage and frequency are normal.

4. The output terminals of the UPS are energized upon the power-on. If the load is connected with the output terminals, make sure that the power to the load is safe.

3.5.2 Single UPS Parameters Setting

Power on the UPS according to step 1 ~ step 4 in 3.5.3, it is prohibited to start the inverter.

For display setting, press the menu key to enter the function setting option, according to Table 3-4. The other settings can be done only by service software ParamSet.

Table 3-4 Single UPS parameters setting

Parameters	Default value	Parameters setting	ParamSet	Display Setting
Single Group Batt Cap	0014	Set the parameter according to the actual battery capacity	x	
Battery Cells Number	32	Set the parameter according to the actual battery number	x	
Equalize Charge Allowed	Enabled	Set the parameter according to the actual battery characteristic	x	
System Configuration	Single	Single	x	
ECO Mode	Normal	Normal	x	
Output frencency level	50Hz	Set the parameter according to the actual power grid, 50Hz/60Hz can be selected	x	
Output voltage level	400V	Set the parameter according to the actual power grid, 380V/400V/415V can be selected	x	
3 Phase Output or 1 Phase Output	Three	Select “Three” when is 3 Phase Output, select ”Single” when is 1 Phase Output		x
Note: output frequency level and output voltage level will be active after power-off, but will not be displayed on LCD panel, the settings will be valid after manual power-off.				

The parameter descriptions and default values of the other parameters are listed in Table 3-5; you can set the parameters according to the actual requirements.

Table 3-5 Parameter descriptions and default values

Parameters	Notes	Default value	ParamSet	Display Setting
Display contrast	Adjust the LCD contrast			x
Date format set	M/D/Y, D/M/Y and Y/M/D formats can be selected	Y/M/D		x
Date & time	Set the date and time			x
Comm1 baud rate	Set the communication baud rate of the USB port	9600		x
Comm2 baud rate	For internal communication only, which cannot be set	9600		x
Comm3 baud rate	Set the communication baud rate of the SNMP card port	9600		x
Communication address	For RS485 communication	1		x
Single Group Batt Cap	Set the parameter according to the actual total battery capacity	0014	x	
Battery Cells Number	Set total battery number	32	x	
Equalize Charge Allowed	Enabled or disabled	Enabled	x	
Temp Compensation	Enabled or disabled	Disabled	x	
Batt Temp Sensor Position	Set the position of the temperature sensor	NONE	x	
Shared Battery	Each UPS in parallel system shares the battery string or not	Disabled	x	
System Configuration	Set the UPS single/parallel	Single	x	
Parallel Requisite Units	Set the parallel units	1	x	
Parallel Redundant units	Set the redundant units	0	x	
ECO Mode	Working in the normal mode or ECO mode	Normal	x	
Output Frequency Level	Set the output frequency	50Hz	x	
Output Voltage Level	Set the output voltage level	400V	x	
LBS Function	Set the LBS function, NONE, SLAVE or MASTER can be selected	NONE	x	
Command password	12345	12345		x
Protocol	Set the UPS communication protocol	Velocity		x
3 Phase Output or 1 Phase Output	Set the output mode: Three or Single	Three		x

Set “Display contrast”, “Date format set” and “Date & time” according to the actual requirements. For Comm1, Comm2 and Comm3 baud rate, 1200, 2400, 4800, 9600 or 19200 can be selected. The interface is shown in Figure 3-12.

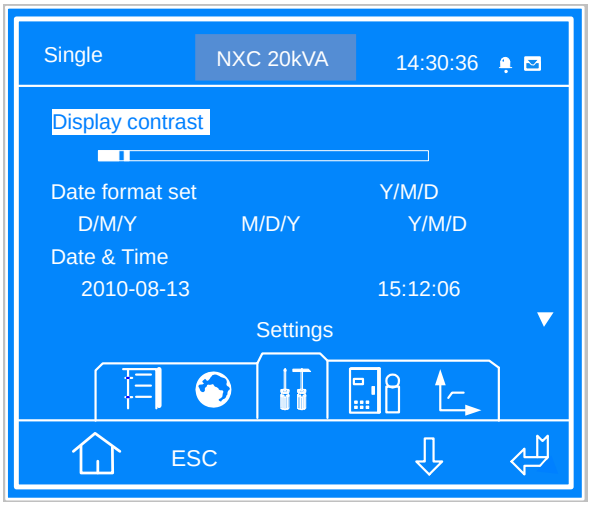


Figure 3-12 Settings interface 1

Set “Single Group Batt Cap” according to the actual total battery capacity, for “Battery Blocks Number”, 30, 32, 34, 36, 38 or 40 can be selected, set “Equalize Charge Allowed”, “Temp Compensation” and “Batt Temp Sensor Position” (battery temperature sensor is optional) according to the user requirement.

Note
The default value of “Battery Cells Number” is “32”, set the paramerter according to the atcual requirement.

Select “Enabled” in “Shared Battery” according to whether the battery is shared. Set “System Configuration” to “Single” if the system is single system. Select “Normal” or “ECO” according to the UPS working mode, select “50Hz” or “60Hz” in “Output Frequency Level” according to the power grid frequency level.

Set “Output Voltage Level” and “LBS Function” according to the user requirement, set “Command password” to “12345”, the default value of “Protocol” is “Velocity”, select “Three” or “Single” in “3 Phase Output or 1 Phase Output”, as shown in Figure 3-13.

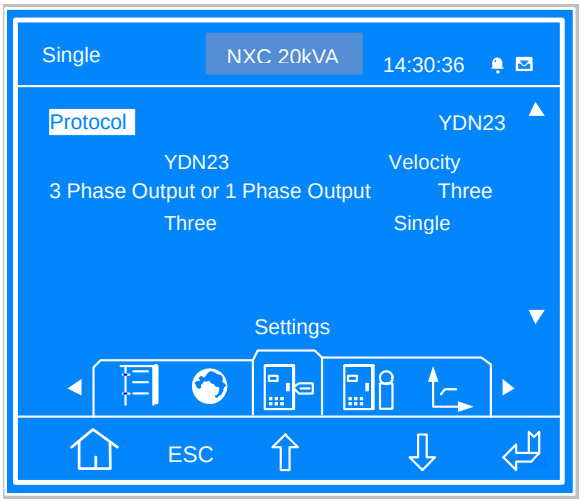


Figure 3-13 Settings interface 3

3.5.3 Normal Mode Start-Up

1. Close the UPS output MCB (QS4), the input MCB (QS1) and the bypass MCB (QS2) on by one. The maintenance bypass MCB (QS3) must be opened.

Warning
After closing the above mentioned MCBs, the UPS output terminal block of the load will be live, pay attention to the personnal safety to avoid electric shock. Note whether it is safe to feed power to load.

2. LCD displays the self-test screen; the fault indicator (red) and inverter indicator (green) are on at the same time for about 5 seconds. After the self-test, UPS enters the bypass state, the fault indicator turns on and the buzzer beeps for 1 second.

3. The rectifier runs in normal state about 30 seconds, the rectifier start-up is finished.

4. Finish and check the parameter settings of the single UPS.

5. Press the ON button for 2 seconds, the inverter indicator (green) are blinking, the inverter starts, and the inverter indicator turns on.

6. Measure whether the inverter output voltage is normal.

7. If the battery is not connected, the fault indicator is blinking. If the battery is connected (internal battery with MCB QS6 and QS7), the fault indicator turns off.

3.5.4 Battery Mode Start-Up

1. Close the battery MCB; press the battery cold start button on the UPS front panel for 2 seconds, the LCD displays the start screen. The fault indicator (red) will blink and the buzzer will beep continuously after the rectifier finish the start.

2. Press the ON button for 2 seconds, the inverter starts, and the inverter indicator (green) turns on.

Chapter 4 Parallel UPS Installation And Commissioning

This chapter describes the features, requirements, installation and commissioning of the parallel system.

The UPS parallel system provides the user with N + X ($2 \leq N + X \leq 4$) parallel configuration, N stands for the basic parallel sets, X stands for the redundant sets.

4.1 Features

1. The software and the hardware of each UPS in parallel system are the same as those of the single UPS. The basic parameters of the parallel system (refer to 4.4.2) and the detailed parameters can be set through the Service Software (for service engineers only). For all UPS of the parallel system, the requirements of the parameter settings are same.

2. The parallel cables form a ring connection (Refer to 4.3.2 for details) to provide reliability and redundancy for system. The intelligent parallel logic provides the user with maximum flexibility. For example, each UPS in the parallel system can be switched off or on in random order; seamless transfer can be achieved between Normal mode and Bypass mode, and the transfer is automatically recoverable: that is, after the overload condition is removed, the system will return to the original operation mode automatically.

3. The total load of the parallel system can be queried through the LCD of each UPS.

4.2 Requirements

A UPS system composed of multiple parallel-connected UPS units is equivalent to a large UPS system. Nevertheless, it provides increased system reliability. To ensure equal utilization of all UPS units and compliance with relevant wiring regulations, the following requirements must be met:

1. All single UPS must have the same capacity and must be connected to the same bypass source.

2. The bypass input power and rectifier input power must be connected to the same neutral line input terminal.

3. If a residual current detector (RCD) is required, it must be set correctly and installed before the same neutral line input terminal, or it must monitor the protective earth current of the system. Refer to *Safety Manual*.

4. The outputs of all single UPS must be connected to the same output bus.

5. As the UPS parallel system is not fitted with any auxiliary contact detection devices for the UPS unit output MCB or maintenance bypass MCB. Removing the single UPS from the parallel system before maintenance and adding the single UPS into the parallel system after maintenance must be conducted strictly following the procedures provided in 6.2. Failure to observe this may affect the load power supply reliability.

4.3 Connecting Power Cables

For each single UPS of the parallel system you need to configure the MCB and cable respectively, refer to 3.4 for the specification.

4.3.1 Connecting I/O Cables

The UPS power cables are connected to the I/O terminal block of the UPS rear panel, the layout of the I/O terminal block is shown in Figure 3-4.

Power distribution mode

The I/O cable connections are divided into four types: 3-in 3-out, common source configuration (factory default), 3-in 3-out, split-bypass configuration, 3-in 1-out, common source configuration, 3-in 1-out, split-bypass configuration. The input and output cable connection procedures of the four power distribution modes are as follows.

Distribution for the parallel system

The diagram of three UPS parallel system is shown in Figure 4-1. Refer to Power distribution mode in 3.4.1 for the cable connection of each UPS. Refer to 3.4 for the measurement of the input, output and battery cables.

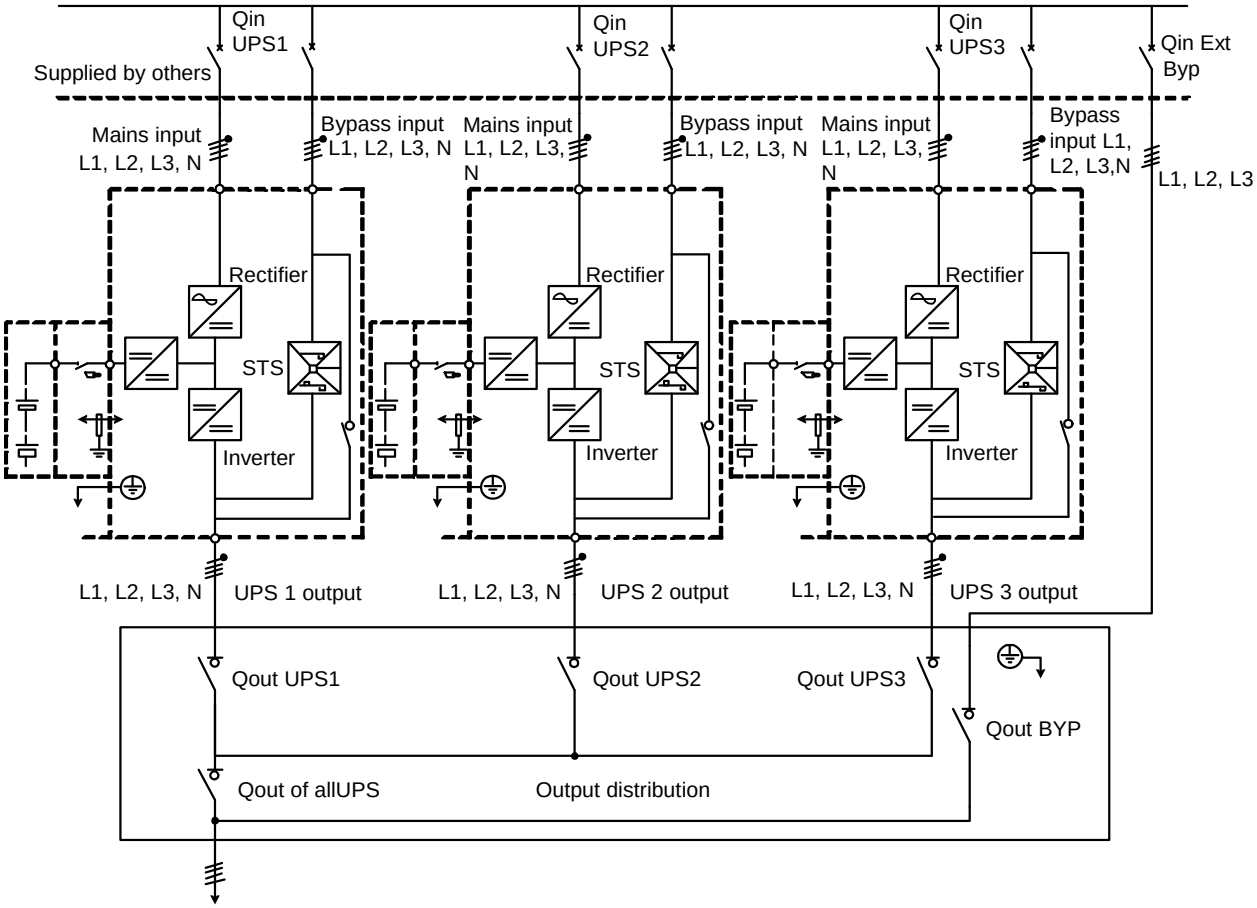


Figure 4-1 1 + N UPS System with External Maintenance Switch

Note
For 1+N installations, an external bypass rated for the total system load must be installed and the UPS internal maintenance bypass must be locked to prevent it from being operated.

When planning and installing the system, the power cables between input distribution and the Bypass and rectifier must be the same length (+/- 10%). The same applies to the power cables between the UPS outputs and the parallel connection point on the load side.

Warning
Each UPS must configure extenal input MCB and extenal output MCB when carring out the power distribution for the parallel system, as shown in Figure 4-1. When operating the external Bypass (Qout BYP) refer to 6.2.6.

Changing power distribution mode

This product is compatible with 3-in 3-out/3-in 1-out, factory default: 3-in 3-out.

Carry out the parallel connection after changing the single system to the required system (refer to Changing power distribution mode in 3.4.1 for the changing method), if you need to change the mode from 3-in 3-out to 3-in 1-out or from 3-in 1-out to 3-in 3-out.

4.3.2 Connecting Parallel Cables

In case of parallel system the optional cable is supplied. The parallel cables form a ring connection through the parallel ports on the UPS rear panel. The cable connection schematic diagram of 3 + 1 parallel system is shown in Figure 4-2. The first port on the left is DB9 male port (needle shape), and the second port on the left is DB9 female port (hole shape).

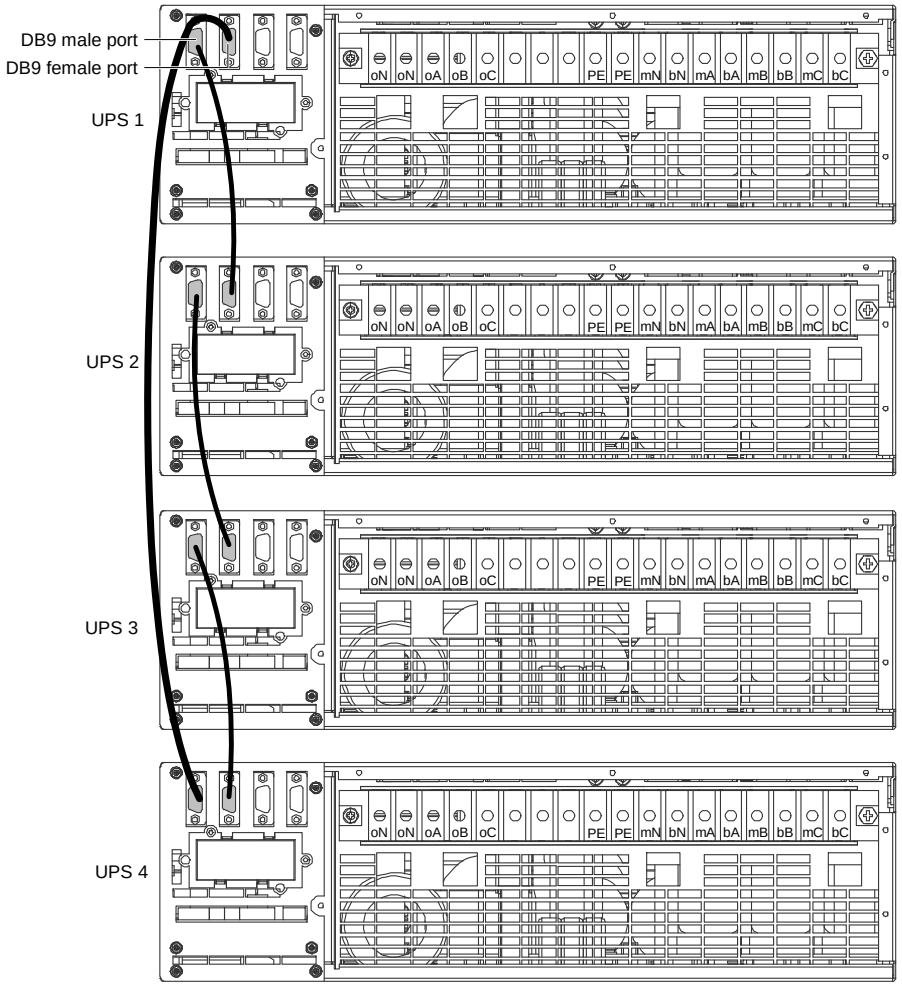


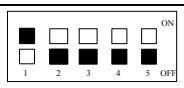
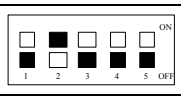
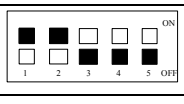
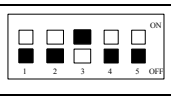
Figure 4-2 Cable connection schematic diagram of 3 + 1 parallel system

Note
1. The Emerson parallel cables must be used for the parallel system. 2. The parallel communication fault occurs when carrying out the parallel commissioning, check whether the connection of the parallel cables is correct, and whether the pin1~ pin9 are connected.

Setting parallel addresses

The parallel addresses for all UPS in parallel system should be set. The parallel addresses can be set through the DIP switch on the UPS front panel (see Figure 1-2). Remove the DIP switch cover, and set the DIP switch according to Table 4-1.

Table 4-1 DIP switch settings

Parallel addresses	Parallel 1#	Parallel 2#	Parallel 3#	Parallel 4#
DIP switch position				

Warning
1. The default setting for DIP switch is '1'. However, you should set the DIP switch position for the parallel system according to the description listed in Table 4-1. Otherwise, the UPS fault will occur. 2. The parallel address must be unique for each UPS unit.

4.3.3 Connecting external Battery Cables

All the UPS in parallel system can either share the battery strings, or use battery strings independently.

Note
Each UPS should be equipped with the independent battery MCB. Refer to Table 3-3 for selection of the battery MCB.

Using battery string independently

When each UPS of the parallel system uses the battery string independently, the battery cable connection of each UPS in parallel system is the same as that of the single UPS, refer to 3.4.2. The schematic diagram of battery strings in 1 + 1 parallel system when using battery strings independently is shown in Figure 4-3.

Note
Make sure that the LCD settings are correct when using the battery strings independently, refer to 4.4.2 for details.

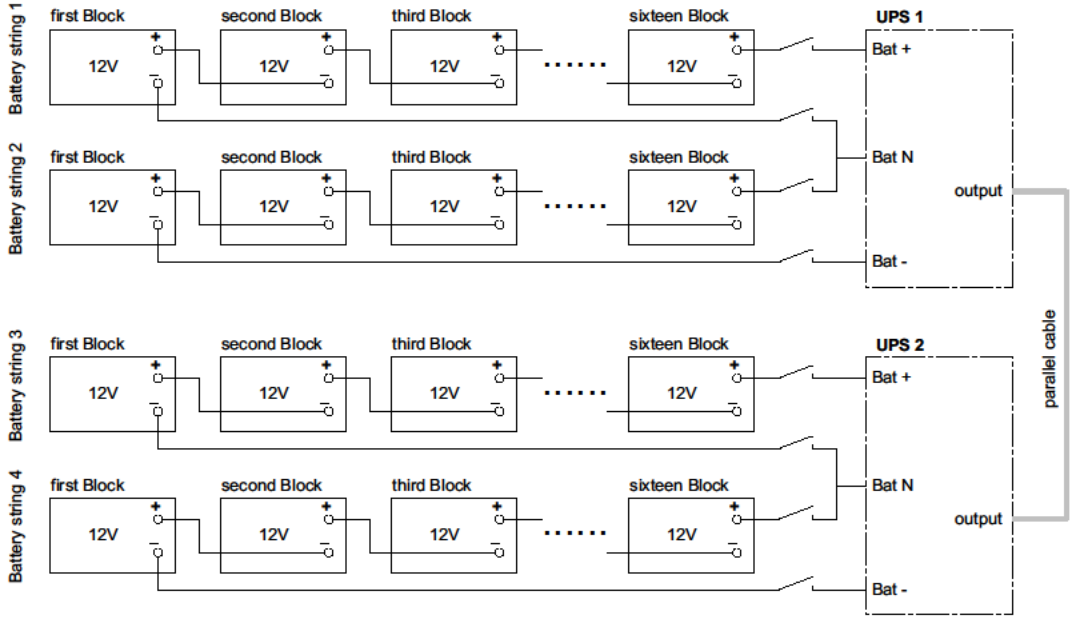


Figure 4-3 Connection principle diagram upon using battery strings independently

Sharing battery string

Using the shared battery string in parallel system can reduce equipment costs.

Note
To ensure the abundant backup time of the battery, it is recommended to use the external battery cabinet with larger capacity.

1. Wiring

Power off the parallel system completely, disconnect the battery MCBs of all single UPS, and then use battery cables (refer to 3.4 for the cables and the MCBs) to connect '+', 'N', '-' and 'PE' terminals of the battery string respectively to 'Bat +', 'Bat N',

'Bat -' and 'PE' terminals of the corresponding UPS I/O terminal block in parallel system through each battery MCB, as shown in Figure 4-4.

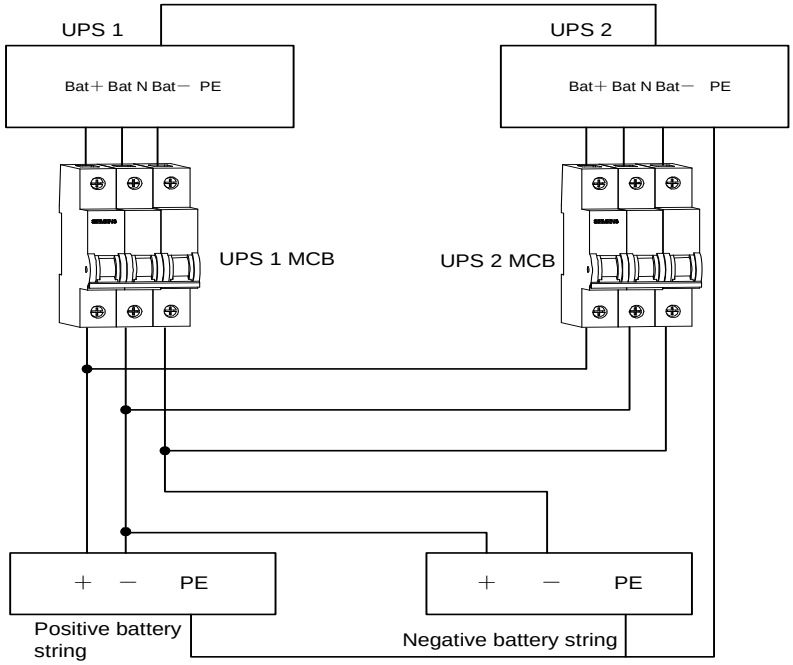


Figure 4-4 Connection diagram of shared battery string in 1 + 1 parallel system

Refer to Figure 4-5 to configure the positive battery string and negative battery string

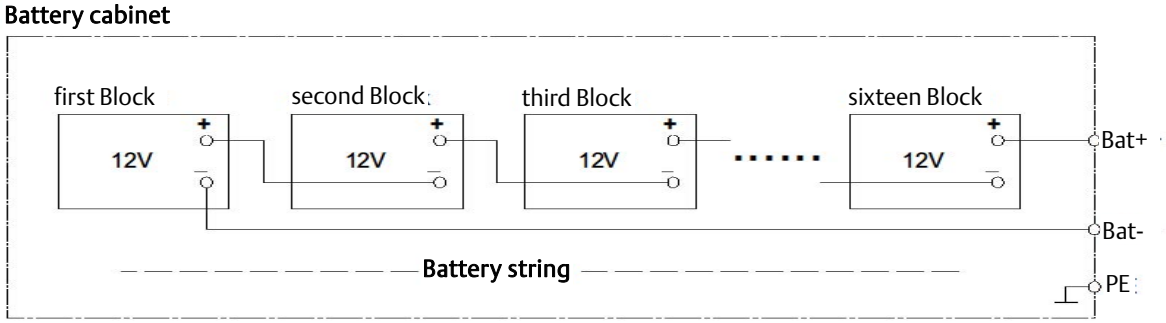


Figure 4-5 Internal connection diagram for positive battery string and negative battery string

2. Setting

Power on the system, set each single UPS to shared battery string configuration through the Service Software 'Settings' -> 'Shared Battery' from each UPS unit; set the Service Software 'Settings' -> 'Battery Cells Number' and 'Single Group Batt Cap' from each UPS unit, and each UPS unit setting must be the same.

Note
1. For the parallel system used the shared battery strings, make sure that the Service Software settings are correct. Refer to 4.4.2 for details of the settings. 2. For the parallel system used the shared battery strings, the 'Single Group Batt Cap' on the Service Software setting of each UPS stands for the total capacity of battery strings, and each UPS can calculate the battery capacity itself automatically.

3. Close the battery MCB of each UPS.

4.4 Commissioning Parallel System

4.4.1 Check Before Power-On

1. Check and confirm that the power distribution mode of the UPS is correct; that the connections of the power cables and signals cable are correct and there is no short circuit.

2. Check that the battery installation and cable connection is correct and there is no short circuit, and that the positive pole and negative pole of the battery is correct. Especially when each UPS of the parallel system shares battery string, check these items carefully.

3. Check all the working status of the parallel system, ensure that the phase sequence of the mains, bypass and output of each UPS is correct and consistent, that the parallel cable connection is reliable, and that the user load is not connected during power-on.

4. Measure and confirm that the mains voltage and frequency is normal.

5. The output terminals of the UPS are energized upon the power-on. If the load is connected with the output terminals, make sure that the power to the load is safe.

Warning
The UPS will be live upon the power-on. When the bypass of the single unit in the parallel system is not consistent, a system fault may occur, check and confirm the bypass before power-on.

4.4.2 Parallel System Parameters Setting

The parallel parameters for all the UPS units in parallel system should be set.

Power ON the each UPS of the parallel system according to step 1) ~ step 4) in 4.4.3, it's prohibited to start the inverter. Set the parallel parameters according to Table 4-2.

Table 4-2 Parallel parameters setting

Parameters	Default value	Parallel parameters setting	ParamSet	Display Setting
Single Group Batt Cap	0014	Set the parameter according to the actual battery capacity	x	
Battery Cells Number	32	Set the parameter according to the actual battery number	x	
Equalize Charge Allowed	Enabled	Set the parameter according to the actual battery characteristic	x	
Shared Battery	Disabled	Select "Enabled" if there is shared battery, select "Disabled" if there is no shared battery	x	
System Configuration	Single	Parallel	x	
Parallel requisite units	1	Set the paramerter to "3" if there are four UPS to form 3 + 1 parallel system	x	
Parallel Redundant Units	0	Set the paramerter to "1" if there are four UPS to form 3 + 1 parallel system	x	
ECO Mode	Normal	Normal	x	
Output frencency level	50Hz	Set the parameter according to the actual power grid, 50Hz/60Hz can be selected	x	
Output voltage level	400V	Set the parameter according to the actual power grid, 380V/400V/415V can be selected	x	
3 Phase Output or 1 Phase Output	Three	Select "Three" when is 3 Phase Output, select "Single" when is 1 Phase Output		x
Note: output frequency level and output voltage level will be active after power-off, but will not be displayed on LCD panel, the settings will be valid after manual power-off.				

The default values of other parameters are listed in Table 3-4.

For the parallel system with N + X ($2 \le N + X \le 4$), set 'System Configuration' to 'Parallel', 'Parallel requisite units' to 'N' ($1 \le N \le 4$), 'Parallel Redundant Units' to 'X' ($0 \le X \le 3$). Take the 3 + 1 parallel system for example, set 'System Configuration' to 'Parallel', 'Parallel requisite units' to '3', 'Parallel Redundant Units' to '1'.

4.4.3 Power-On Commissioning For Parallel System

Power on and commission each UPS of the parallel system respectively, namely power on one UPS at a time, and other UPS are in the powered- down status, the specific commissioning procedures are as follows:

1) Close the external output MCB and input MCB of one UPS, the UPS is powered on. Ensure that other UPS MCBs are opened. Close the corresponding internal input Output Circuit Breaker, bypass MCB and output MCB of the UPS.

Warning
After closing the UPS external output MCB and UPS internal output MCB, the UPS output terminal block, the distribution output terminals and load will be live, pay attention to the personnal safety to avoid electric shock. Note whether it is safe to feed power to load.

2) LCD displays the self-test screen; the fault indicator (red) and inverter indicator (green) are on at the same time for about 5 seconds. After the self-test, UPS enters the bypass mode, the fault indicator turns on and the buzzer beeps for 1 second.

3) After about 30 seconds the rectifier start-up is finished and the rectifier runs in normal mode.

4) Finish and check the parallel parameter settings.

5) Press the ON button for 2 seconds, the inverter indicator (green) is blinking, the inverter starts, and the inverter indicator turns green.

6) If the battery is not connected, the fault indicator is blinking. If the battery is connected, the fault indicator turns off.

7) If the UPS is working normally, turn off the UPS.

8) Repeat the preceding step 1) ~ step7) to power on and commission the other UPS respectively.

Note
Carry out the parallel commissioning after each UPS is working normally.

Confirm that each UPS has been powered on and working normally, commission the parallel system, the specific procedures are as follows:

1) Close the external output MCB and input MCB and the corresponding UPS internal MCBs of one UPS. The UPS is powered on and enters Bypass mode. The rectifier starts. Press the ON button for 2 seconds, the inverter indicator turns on. Measure whether the inverter output voltage is normal.

2) Close the external output MCB and input MCB and the corresponding UPS internal MCBs of the second UPS. Follow the preceding steps to start the inverter of the second UPS, check whether there is any alarm on the LCD, and confirm that the UPS parallel works normally.

3) Follow the methods to start up the inverter of the third or fourth UPS to connect the UPS into the parallel system.

Waring
During the parallel system power-on, confirm that the external output MCB of each UPS has been closed, and that all the inverter outputs of the UPS are connected in parallel.

4.5 Installation And Commissioning For Double Bus System with common neutral

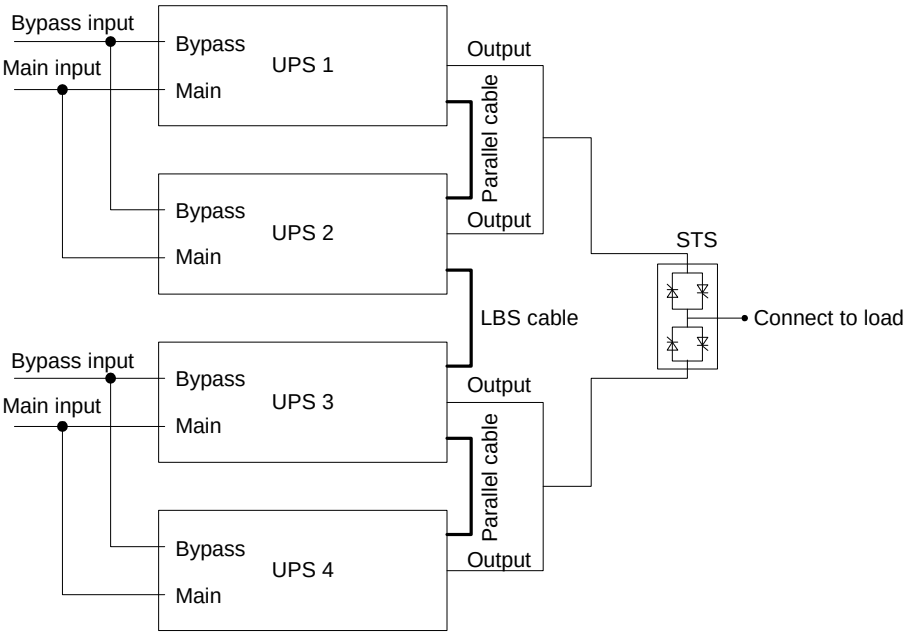
4.5.1 Introduction

The double bus system consists of two independent UPS systems; each UPS system consists of one single UPS, or two or more parallel-connected UPS.

The double bus system has high reliability, which is suitable for the load with dual input terminals. For single UPS input load, you can add a static transfer switch (STS, optional) and enable the standard Load Bus Synchronization (LBS) system.

Place the UPS side by side, and connect the UPS as follows:

The double bus system uses the LBS system to realize the output synchronization of the two independent (or parallel) UPS systems. One is the master system, and the other is the slave system. The operation mode of the double bus system contains master system and/or slave system running in normal mode or bypass mode. The schematic diagram of the LBS system consisting of 1 + 1 parallel system is shown in Figure 4-6.



Note: UPS1 and UPS2 are master systems, UPS3 and UPS4 are slave systems

Figure 4-6 LBS system schematic diagram

Note
For the DIP switch settings and the parallel commissioning, refer to 4.3.2 and 4.5 respectively.

4.5.2 Installing External Protective Device

See 3.3 for details of installation and type selection.

4.5.3 Connecting Power Cables

In double bus system, refer to *3.4* and 4.3 to select the power cables for single UPS and parallel system respectively. The bypass input power and mains input power must use the same neutral input terminal. The leakage current protective device should be installed before the input terminal.

4.5.4 Connecting LBS Cables

In double bus system, connect the two ends of the LBS cable to any LBS port of the two parallel systems respectively, as shown in Figure 4-7. The third port on the left is DB9 male port (needle shape), the fourth port on the left is DB9 female (hole shape).

Note
1. The appearances of the LBS ports (see Figure 1-3) and the parallel ports (see Figure 1-3) are the same, but the positions are different. Be careful when inserting and connecting to avoid incorrect connnection. 2. For the double bus system formed by parallel UPS, it is recommended to prepare two LBS cables, one is used to connect any of the two LBS ports of the two parallel system, the other is redundant cable which is used for reliable connection. 3. As shown in Figure 4-7, one cable is LBS cable, others are parallel cables.

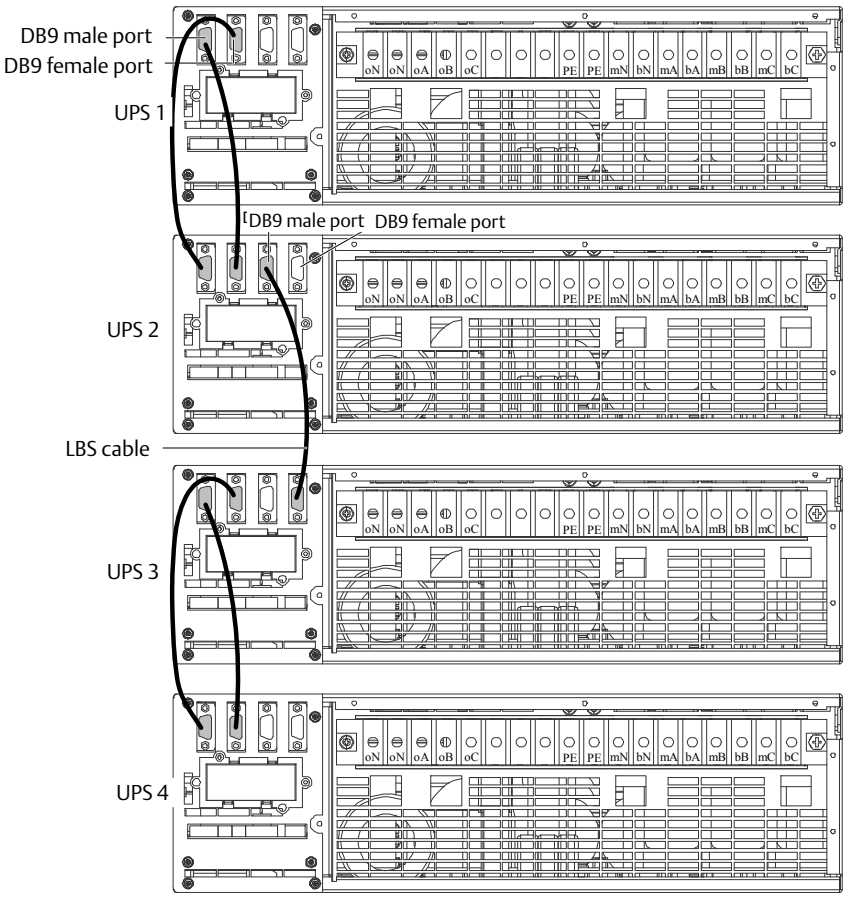


Figure 4-7 LBS cable connection

4.5.5 Setting up the Double Bus System parameters

Using the double bus system formed by 1 + 1 parallel system as an example, set ‘System Configuration’ to ‘Parallel’, ‘Parallel requisite units’ to ‘1’, ‘Parallel Redundant Units’ to ‘1’. For the master system, set ‘LBS Function’ to ‘MASTER’. For the slave system, set ‘LBS Function’ to ‘SLAVE’. Ensure that the setting for ‘3 Phase Output or 1 Phase Output’ of each single UPS in the double bus system is same, as shown in Figure 4-8.

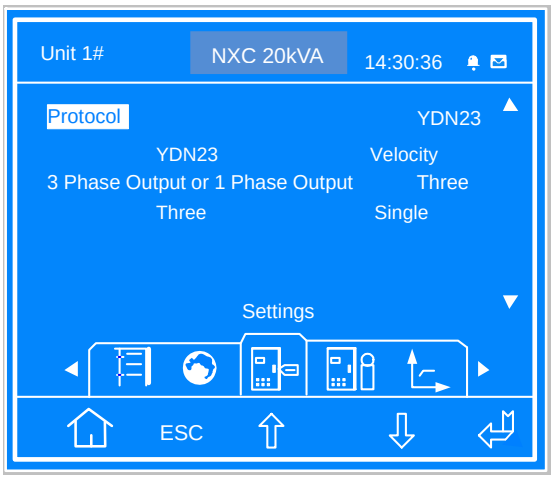


Figure 4-8 Setting interface

Chapter 5 Operation And Display Panel

This chapter introduces the functions and use of the components on the UPS operation and display panel, and provides LCD display information, including the LCD screen types, detailed menu messages, prompt windows message and UPS alarm list.

5.1 Introduction

The operation and display panel is located on the front panel of the UPS. Through the operation and display panel, you can conduct the UPS operation control and query UPS parameters, UPS and battery states, and alarm message.

As shown in Figure 5-1, the operation and display panel provides LCD, menu buttons (F1 ~ F4、HELP)、LED indicators (inverter indicator and fault indicator), control buttons (FAULT CLEAR, ON, OFF, ALARM CLEAR, EPO).

Figure 5-1 Operation and display panel

5.1.1 LED Indicators

The LED indicators are composed of inverter indicator and fault indicator. Table 5-1 gives the indicators description.

Table 5-1 Description of LED indicators

Indicator	Color	State	Meaning
Inverter indicator	Green	On	Load power is supplied by the inverter
		Blinking	Inverter on, starting up, synchronizing, or standing by (ECO mode)
		Off	Inverter not operating
Fault indicator	Red	Blinking	General fault (such as no battery)
		On	Serious fault (such as inverter fault)
		Off	No fault

5.1.2 Audible Alarm (Buzzer)

The UPS activity is accompanied with the following two different kinds of audible alarms shown in Table 5-2.

Table 5-2 Audible alarm description

Sound	Meaning
One beep every second	Sound is generated when the UPS alarm appears, such as AC input failure
Continuous beep	Sound is generated when the UPS fault appears, such as fuse or hardware failure

5.1.3 Control Buttons

The operation and display panel provides five control buttons, the functions of which are described in Table 5-3.

Table 5-3 Description of control buttons

Control button	Silk print	Description
EPO switch	EPO	Used to disconnect the load power and close the rectifier, inverter, static bypass and battery
Inverter on	ON	Used to start the inverter
Inverter off	OFF	Used to stop the inverter
Fault recovery on/off	FAULT CLEAR	Restore the UPS function (clear fault in advance)
Alarm sound silence on/off	ALARM CLEAR	When an audible alarm is active, press this button to silence the audible alarm. Press this button again can restart the buzzer

5.1.4 LCD And Menu Buttons

The operation and display panel is composed of an LCD and five menu buttons (F1, F2, F3, F4, HELP). Table 5-4 gives the menu buttons function description.

Table 5-4 Menu buttons function description

Button	F1	F2	F3	F4	HELP
Function 1	HOME	ESC Escape	Left	Right	Enter
Function 2			Up	Down	

LCD provides you with the user-friendly interface and the 320 × 240 dot matrix image display. The menu-driven LCD allows you to easily browse through the input, output, load and battery parameters, learn about the current UPS status and alarm message, perform functional setting and control operation. The LCD also stores up to 512 historical alarm records that can be retrieved for reference and diagnosis.

5.2 LCD Screen Types

5.2.1 Start Screen

Upon UPS start, the UPS executes the system self-test, and the start screen will appear and remain about 15 seconds, as shown in Figure 5-2.

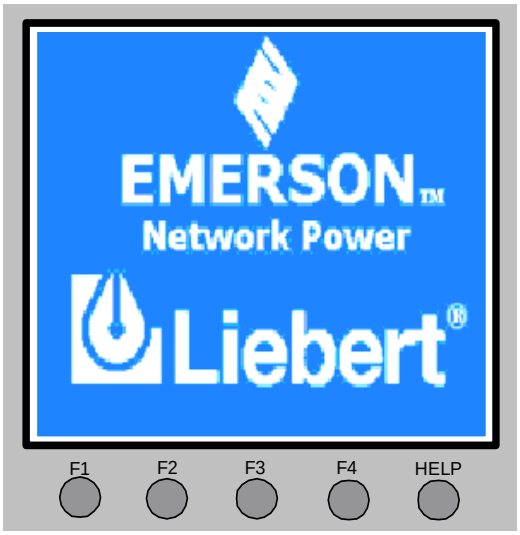


Figure 5-2 Start screen

5.2.2 Primary Screen

After the UPS system self-test, the primary screen shown in Figure 5-3 will appear. The primary screen is composed of four windows: system information window, data window, menu window and keypad window.

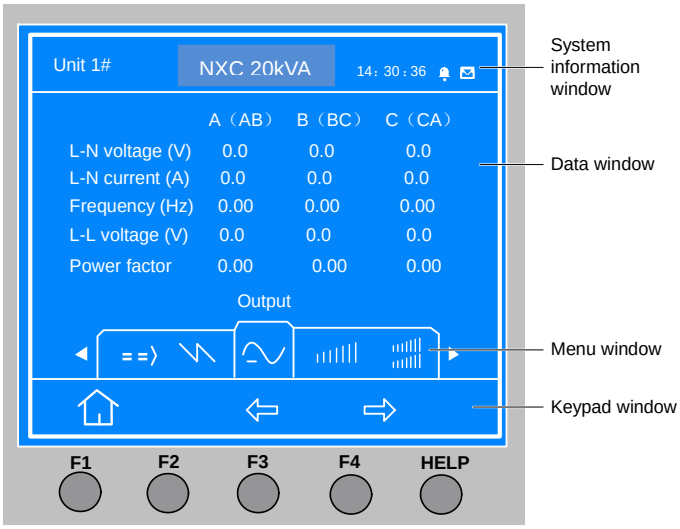


Figure 5-3 Primary screen

The current icons on top of the F1 ~ F4 and HELP menu buttons give the explanations of each button. From any menu in the primary screen, pressing the F1 button will return to the 'Output' menu. For details about the primary screen, refer to 5.3.

5.2.3 Default Screen

During the UPS operation, if there is no alarm within 2 minutes, the default screen shown in Figure 5-4 will appear. After a short while, the LCD backlight will turn off. Press any menu button (F1 ~ F4, HELP), the primary screen will appear again.

Figure 5-4 Default screen

5.3 Detailed Description Of Menu Items

The description in the following refers to the LCD primary screen shown in Figure 5-3.

System information window

The system information window displays the current time and the UPS name. This window is purely for information - no settings are adjustments are made here. For details, see Table 5-5.

Table 5-5 System information window

Item	Explanation
Liebert NXC 020kVA	UPS name, which stands for Liebert® Liebert NXC 20kVA UPS
12: 30: 36	Current time (format: 24 Hours, h: min: s)

Menu window and data window

The menu window displays the menu name of the data window. The data window displays the items of the menu selected from the menu window. UPS parameters can be browsed and functions can be set through the menu window and data window. Details are given in Table 5-6.

Table 5-6 Menu window and data window

Menu	Item	Explanation
Mains	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Input frequency
	L-L voltage (V)	Line voltage
	Power factor	Power factor
Bypass	L-N voltage (V)	Phase voltage
	Frequency (Hz)	Bypass frequency
	L-L voltage (V)	Line voltage
Output	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Output frequency
	L-L voltage (V)	Line voltage
	Power factor	Power factor
Load	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Load level (%)	The percentage of the UPS rated load
	Crest factor	Output current crest factor
System	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
Battery	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Battery temperature (°C)
	Battery remain time (Min.)	Battery runtime remaining
	Battery boost charging	Battery is boost charging
	Battery float charging	Battery is float charging
	Battery is not connected	Battery is not connected
Event	Current alarm	Display the current alarm. See Table 5-8 for UPS alarm message list
Records	Historical alarm	Display all historical alarms. See Table 5-8 for UPS alarm message list
Language	Language selection	Options are displayed in 13 languages: Swedish, Spanish, Russian, Chinese, Portuguese, Polish, Italian, German, French, English, Dutch, Czech, and Turkish

Menu	Item	Explanation	ParamSet	Display Setting
Settings	Display contrast	Adjust the LCD contrast		x
	Date format set	MM DD YYYY, DD MM YYYY and YYYY MM DD formats can be selected		x
	Date & time	Set the date and time		x
	Comm1 baud rate	Set the communication baud rate of the USB port		x
	Comm2 baud rate	For internal communication only, which cannot be set		x
	Comm3 baud rate	Set the communication baud rate of the SNMP card port		x
	Communication address	For RS485 communication		x
	Single Group Batt Cap	Set the total battery capacity according to the configuration	x	
Settings	Battery blocks Number	Set the battery block. Option: 30- block, 32- block, 34- block, 36-block, 38- block, 40- block	x	
	Equalize Charge Allowed	Enabled or disabled	x	
	Temp Compensation	Enabled or disabled	x	
	Temp Sensor Position	Set the position of the temperature sensor	x	
	Shared Battery	Each UPS unit in parallel system shares the battery string or not	x	
	System Configuration	Set the UPS single/parallel	x	
	Parallel Requisite Units	Set the parallel units	x	
	Parallel Redundant units	Set the redundant units	x	
	ECO Mode	Set the operation mode. Option: Normal, ECO	x	
	Output Frequency Level	Set the output frequency	x	
	Output Voltage Level	Set the output voltage level	x	
	LBS Function	Set LBS function. Option: NONE, SLAVE or MASTER	x	
	Command password	You can change the command password. Default: '12345'		x
	Protocol	Set the communication protocol of the UPS		x
	3-in 3-out/3-in 1-out	Set the output system: 3-in 3-out or 3-in 1-out This setting can only be carried out after the EPO operation. After the setting, you must power off the system, and confirm that the system actual wiring mode complies with the setting. Power on the system again, and the setting can take effect		x
Command	Battery maintenance test	The battery maintenance test will partly discharge the battery to get rough assessment of the battery capacity. The load ranges from 20% to 100%		
	Battery capacity test	The battery capacity test will completely discharge the battery to get accurate assessment of the battery capacity. The load ranges from 20% to 100%		
	System test	The UPS self-test. The user starts this function, 5 seconds later, a pop window will appear to show the test result		
	Stop testing	Manually stop the test, including the maintenance test, capacity test and system test		
	Forcing charge	Manually conduct the battery forcing charge		
	Stop forcing charge	Manually stop the battery forcing charge		
Version	Monitor Version	Provide the monitor software version		
	Rectifier Version	Provide the rectifier software version		
	Inverter Version	Provide the inverter software version		

Keypad window

The function of menu buttons (F1 ~ F4 and HELP) is shown in icon mode for the current display screen (see Figure 5-4).

5.4 Prompt Window

A prompt window is displayed during the operation of the system to alert you to certain conditions and/or to require your confirmation of a command. The prompts and meanings are given in Table 5-7.

Table 5-7 Prompts and meanings

Prompt	Meaning
Transfer with interrupt, confirm or cancel	Inverter and bypass supplies are not synchronized, and the load transfer between the bypass and inverter will cause a brief power supply interruption
This operation leads to output shutdown, confirm or cancel	The bypass is abnormal, inverter shutdown will cause the load power-off
Turn on more UPS to carry current load	The number of paralleled inverters already turned on is insufficient to carry the current load, thus more inverters are required
Battery will be depleted, confirm or cancel	The battery maintenance test discharges the battery completely. A prompt screen will appear to require your confirmation. Cancelling the test will end the battery discharge and return to the Normal mode
System self-test finished, everything is ok	No operation is required
System self-test finished, please check the current warnings	Check the current alarm message
Enter control password	Control password is required for battery test or UPS test
Battery self-test condition is low, please check battery state and load level	Battery test condition is not met. Please check whether the battery is in boost charge state and the load level is more than 20%
Forcing charge condition is low, please check battery state	The prompt appears when you select the forcing charge command while the forcing charge condition is not met (such as no battery, charger failure)
Check the wiring according to the settings, power-off takes effect, 3-phase (1-phase) output	After the menu '3 Phase Output or 1 Phase Output' is set, you can power off the system completely, and then power on the system again after the wiring is changed according to the settings

5.5 UPS Alarm Message List

Table 5-8 gives the UPS alarm message list based on the 'Event' and 'Records' menus.

Table 5-8 UPS alarm message list

Alarm message	Description
Inverter comm. fail	Internal communication failure between the monitoring board and the inverter
Rectifier comm. fail	Internal communication failure between the monitoring board and the rectifier
Parallel comm. fail	The communication failure between different UPS within a parallel system. 1. Check if there are some UPS not powered on in parallel system. If so, power on these UPS and check if the alarm disappears. 2. Press the FAULT CLEAR button
Battery fault	Battery is depleted (reserved)
Battery replaced	Battery test failure, and the battery should be replaced
Battery low pre-warning	Before the end of the discharge, battery undervoltage pre-warning may occur. After this pre-warning, the battery should have the capacity for 3 minutes discharging with full load. The time is user-configured ranging from 3 minutes to 60 minutes. Shut down the load in time
Battery stop discharge	Inverter is off due to the battery end voltage. Check the mains failure and try to recover it
Mains volt. abnormal	Mains voltage exceeds the upper or lower limit and results in rectifier shutdown. Check the input phase voltage of the rectifier
Mains undervoltage	Mains is undervoltage, reduce load to keep running. Check the input line voltage
Mains freq. abnormal	Mains frequency is out of the limit range and results in rectifier shutdown. Check the input frequency
Rectifier block	Rectifier failure. The rectifier shuts down and the battery discharges
Rectifier overtemp.	The temperature of heat sink is too high to keep the rectifier running. The UPS can recover automatically. Check the environment and ventilation
Battery charger fault	Battery charger is over voltage
Control power 1 fail	UPS operates but the control power is not available
Mains phase reversed	AC input phase sequence is reversed
Rectifier overcurrent	Rectifier is over current
Soft start fail	Rectifier cannot start due to the DC bus low voltage

Alarm message	Description
Bypass unable to trace	This alarm is triggered by an inverter software program when the amplitude or frequency of bypass voltage is beyond the normal range. The amplitude threshold is fixed at ±10% of nominal rating. This alarm will automatically recover when the bypass voltage is normal. 1. First verify that the bypass voltage and frequency displayed on the LCD are within the selected range. Note that the rated voltage and frequency are specified by the 'Output Voltage Level' and 'Output Frequency Level' respectively. 2. If the displayed voltage is abnormal, please verify the actual bypass voltage and frequency presented to the UPS. Check the external power if any fault is found
Bypass protection	This alarm is triggered by an inverter software program when the amplitude or frequency of bypass voltage is too high or too low. The amplitude threshold is fixed at ±10% of nominal rating. This alarm will automatically recover when the bypass voltage is normal. 1. First check if there are some relevant alarms, such as 'Bypass Phase Reverse', 'Input Disconnect Fault'. If so, solve them first. 2. Then verify that the bypass voltage and frequency displayed on the LCD are within the selected range. Note that the rated voltage and frequency are specified by the 'Output Voltage Level' and 'Output Frequency Level' respectively. 3. If the displayed voltage is abnormal, please verify the actual bypass voltage and frequency presented to the UPS. Check the external power if any fault is found. If the utility is likely to trigger this alarm frequently, the bypass limit can be increased through the configuration software according to the user feedback
Inverter asynchronous	This alarm is triggered by an inverter software program when the inverter and bypass waveforms are misaligned by more than 6 degrees in phase. The amplitude threshold is fixed at ±10% of nominal rating. This alarm will recover automatically when the alarm condition disappears. 1. First check if the alarm 'Bypass Unable To Trace' or 'Bypass Protection' exits. If so, solve it first. 2. Verify the waveform of the bypass voltage. If too distorted, ask the user to verify it and seek any possible measurement
Inverter fault	Inverter output voltage beyond limits. Load transfers to bypass
Inverter overtemp.	The temperature of the inverter heat sink is too high to keep the inverter running. This alarm is triggered by the signal from a temperature monitoring thermostat on the inverter bridge heat sink. The alarm is cleared after about 20 minutes, the inverter will start again automatically. The UPS will switch to bypass if the alarm is triggered more than one time in 2 hours, and a manual power-on of the UPS is required to stitch back to inverter working state after the alarm is cleared. Note: Wait for 20 minutes after the alarm is cleared, then manual power-on will be suceesful. 1. high ambient temperature 2. blocked cooling airway 3. any fan failure 4. prolonged inverter overload
Fan fault	At least one of the cooling fans has failed
Inverter relay fail	At least one of the relays of inverter side is open or short circuit. This fault is latched until power off (for a 3-in 1-out system, possible causes for relay fault type: inverter fuse open, inverter IGBT open)
Bypass STS fail	At least one of the static switches of bypass side is open or short circuit. This fault is latched until power off
Operation invalid	Incorrect operation
Neighbour bypass STS fail	At least one of the bypass static switches of a UPS unit in parallel system is open or short circuit. This fault is latched until power off
Output fuse fail	At least one inverter output fuse failure. The inverter shuts down, the load transfers to bypass
Unit over load	The UPS is confirmed to be overloaded when the load is above 105% nominal rating. The alarm automatically recovers after the overload condition is removed. 1. Confirm that the alarm is true by checking the load percentage indicated on the LCD to determine which phase is being overloaded. 2. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect the unnecessary load if possible.
Byp. abnormal shutdown	Both bypass and inverter voltages are abnormal. Load interruption
Inverter over current	Inverter pulse width modulation module is over current
Bypass phase reverse	The phase sequence direction of the bypass voltage is reversed. Normally, the phase of phase B lags 120 degrees behind phase A, and the phase of phase C lags 120 degrees behind phase B. Verify that the phase rotation of the bypass supply presented to the UPS is correct, and rectify it if the fault is found

Alarm message	Description
Load impact transfers bypass	A transfer to bypass occurred due to a large step load. The UPS will recover automatically. Turn on the load in sequential order to reduce the step load of the inverter
Transfer time-out	The load is on bypass power due to the excessive number of transfers that occurred within the last hour. The UPS will recover automatically and will transfer the load to inverter power within an hour
Bus abnormal	DC bus voltage is abnormal. Inverter shuts down. Load transfers to bypass
DC bus over voltage	Rectifier and inverter are off because the DC bus voltage is too high. Check whether there is a fault in rectifier side. If not, check whether there is an overload. After recovering the fault, restart the inverter
Bypass over current	Bypass current is over limit above 135% rating. The UPS just alarms without any action
Setting save error	Historical records are not saved (Reserved)
Input Disconnect Fault	AC mains input neutral line is not checked out
Protocol version clash	Firmware incompatibility between monitor board and Digital Signal Processor (DSP) board
Manual on	Manually turn on the inverter through pressing ON on the operation and display panel
Manual off	Manually turn off the inverter through pressing OFF on the operation and display panel
EPO	Press the EPO button directly or receive the external EPO command
Transfer confirm	Prompt to press the Enter button to acknowledge that an interrupted load transfer to bypass will happen
Transfer cancel	Prompt to press the ESC button to avoid that an interrupted load transfer to bypass will happen
Fault clear	Press FAULT CLEAR
Alarm silence	Press ALARM CLEAR
Turn on fail	Inverter failed to turn on manually. The reason may be the invalid operation (maintenance bypass breaker closed), or DC bus or rectifier not ready
Alarm silence cancle	Press FAULT CLEAR or ALARM CLEAR
Bypass mode	The UPS is in Bypass mode
Normal mode	The UPS is in Normal mode
Battery mode	The UPS is in Battery mode
Check UPS output	1. Whether the EPO terminal is on the dry contact port 4 2. Whether the LCD displays “Parallel comm. Fail”
Battery float charging	Battery status (floating charge mode)
Battery boost charging	Battery status (boost charge mode)
Battery discharging	Battery status (discharge mode)
Battery period testing	Automatic periodic battery maintenance test (20% capacity discharge)
Batt. capacity testing	User initiated battery capacity test (100% capacity discharge)
Batt. maint. testing	User initiated maintenance test (20% capacity discharge)
UPS system testing	User initiated UPS system self-test
Inverter in setting	Inverter is starting up and synchronizing
Rectifier in setting	Rectifier is starting up and synchronizing
Battery reverse	Reconnect the battery, and check the battery wiring
No battery	Check the battery and battery wiring
Auto start	UPS is off when the battery discharges completely, the inverter will automatically start after the mains is restored
REC FLASH UPDATE	Ongoing update of rectifier firmware
INV FLASH UPDATE	Ongoing update of inverter firmware
MONITOR FLASH UPDATE	Ongoing update of monitor firmware
DSP software error	Inverter software does not match the rectifier software
Operation invalid and Bypass unable to trace	Alarm combination, when the two alarms appear at the same time, the UPS I/O cable connection mode is not suitable with the setting mode (3-in 3-out or 3-in 1-out)
Note: If the alarm is caused through setting the software value by Emerson authorized engineer, and you wish to change the setting values, please get in touch with the Emerson local customer service center	

Chapter 6 UPS Operation Instructions

This chapter gives a detailed description of the UPS operation procedures.

During the operation, the buzzer alarm may appear, at this point, you can press the ALARM CLEAR button to silence the audible alarm.

Warning: hazardous mains and/or battery voltage exists behind the protective cover
No customer operation parts are located behind the protective covers that require a tool for removal. Only qualified service personnel are authorized to remove such covers.

6.1 UPS Start-Up

The start-up procedures can be performed after the installation is finished, the system has been commissioned by authorized engineer and the external input MCBs are closed.

Warning
This procedure results in mains voltage being applied to the UPS output terminals. Confirm that the load power is safe, if there is a load to be connected with the UPS output terminal. Ensure that the load is isolated from the UPS output terminals if the load is not ready for accepting the power.

The start-up mode of the single UPS includes normal mode start-up and battery mode start-up; refer to 3.5.3 and 3.5.4 for details.

For the detailed information of the parallel UPS, refer to 4.4.3.

6.2 Transfer Procedures Between Operation Modes

Note
The Inverter operation mode include Normal mode (mains inverter) and Battery module (battery inverter).

6.2.1 Transfer From Normal Mode To Battery Mode

In the event of mains failure, the UPS will transfer to Battery mode. If you wish to transfer the UPS from Battery mode to Normal mode, you should wait few seconds for mains input recovery. 10 seconds later, the rectifier will restart automatically, and the rectifier will restore the power.

6.2.2 Transfer From Inverter Mode To Bypass Mode

In Inverter mode, press the OFF button for 2 seconds, you can transfer the UPS to Bypass mode.

Note
In Bypass mode, the load accepts the power not from the pure power generated by the inverter, but from the mains power directly.

For the detailed information of the Normal mode, Bypass mode, Battery and Maintenance Bypass mode, please refer to 1.5.

6.2.3 Transfer From Bypass Mode To Inverter Mode

In Bypass mode, press the ON button for 2 seconds. After the inverter runs in normal state, the UPS transfers to Normal mode.

6.2.4 Transfer From Inverter Mode To Maintenance Bypass Mode

When the UPS is running in Normal mode, you can use this procedure to make the load transfer from inverter output to maintenance bypass.

Caution
Before performing this procedure, you should check the LED information first, and make sure the bypass is normal and inverter synchronized. Otherwise, it may result in the load power interruption for a while.

1. Press the OFF for 2 seconds.

The inverter indicators are off and the buzzer alarms. The load transfers to the static bypass, and the inverter shuts down.

Note
Press the ALARM CLEAR button can silence the alarm, but the alarm message of the the LCD does not disappear until the alarm status is cleared.

2. Close the maintenance bypass MCB (QS3) on the UPS rear panel, and the maintenance bypass can supply power to the load.

Warning
If you wish to maintain the UPS module, open the battery MCB QS6 and QS7, and you should wait 10 minutes for the internal DC bus capacitance voltage discharging.

3. Disconnect the main/bypass input switch and output switch (MCB QS1, QS2 and QS4)

Caution
1. When the UPS is in Maintenance Bypass mode, the load does not have the mains abnormal protection. 2. After the UPS transfers to the maintenance bypass, the UPS is not in operation, and the LCD is not displayed, and only the user terminal block is electrified. Be careful when removing the UPS module for maintainance.

6.2.5 Transfer From Maintenance Bypass Mode To Inverter Mode

After UPS maintenance, you can use this procedure to transfer the load from the maintenance bypass to the inverter.

Warning
As no auxiliary contact information of the maintenance bypass MCB QS3 is introduced into the UPS, UPS operation restoration after maintenance must be done strictly following this procedure. Failure to observe this may cause damage to the equipment.

1. Close the output MCB QS4 on the rear panel of the UPS.

2. Close the mains input MCB QS1 and bypass input MCB QS2 on the rear panel of the UPS.

3. Wait until the UPS starts to operate in Bypass mode, and open the maintenance bypass MCB QS3 on the rear panel of the UPS.

4. Press the ON button on the operation and display panel of the UPS, and the UPS transfers to Inverter mode.

6.2.6 Operation with the external Maintenance Bypass in parallel systems

Refer also to Figure 4-1.

In parallel UPS systems, the internal maintenance bypass switches QS3 must be switched off and locked in this position.

Ensure that all the internal bypass switches (STS) are in “ON” status (check status on displays) before switching the maintenance bypass switch (“Qout BYP) on.

There is no interruption in the power supply to the load.

Ensure that all the internal bypass switches (STS) are in “ON” status (check status on displays) before switching the maintenance bypass switch (“Qout BYP) off.

There is no interruption in the power supply to the load.

To disconnect the load, switch off the “Qout of all UPS” switch, followed by the external maintenance bypass switch.

6.3 UPS Complete Shutdown

If you need to shut down the UPS completely, transfer the UPS from Inverter mode to Maintenance Bypass mode according to the procedures in *6.2.4*, so as not to effect the load during the UPS power-off. Then if the power to the load is not needed, open the maintenance bypass MCB directly, as shown in Figure 6-1.

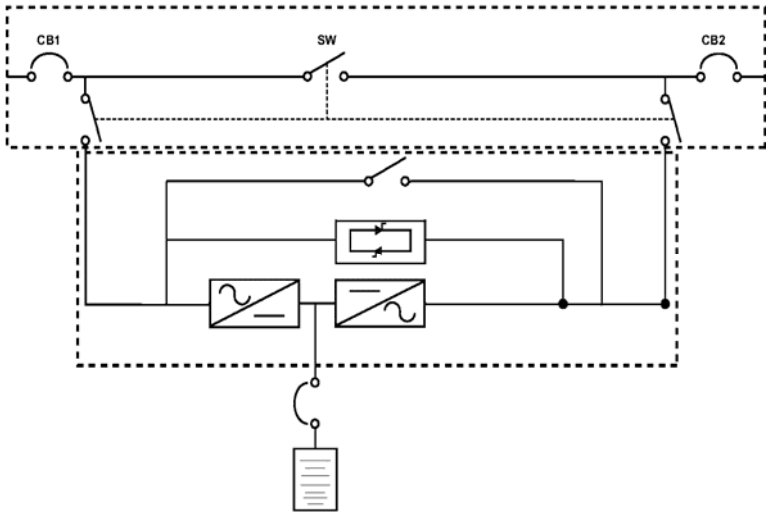


Figure 6-1 Configuration of the UPS with external maintenance bypass

In the case of UPS installation that use the customer's power distribution system, to isolate the UPS from AC power, it is necessary to open the external input MCB. (If the mains and bypass are independently powered, close the two input MCBs).

Caution
Open the maintenance bypass input in order to prevent the physical injury.

6.4 EPO

EPO switch is designed to switch off the UPS in emergency conditions (such as fire, flood). The system will turn off the rectifier, inverter and stop powering the load immediately (inverter and bypass output included), and the battery stops charging or discharging.

If the mains input is present, the UPS control circuit will remain active; however, the output is opened. To remove all mains power from the UPS, the external input switch should be disconnected.

6.5 Auto Restart

When the mains power failure, the UPS draws power from the battery to supply the load until the batteries end of discharge is reached, then the UPS will shut down.

The UPS will automatically restart and recover output power supply:

- After the mains power is restored.
- The UPS Auto Restart function is enabled.
- After the Auto Restart is delayed (default: 10 minutes). During the Auto Restart delay, the UPS will charge the battery to provide a safety margin for equipment shutdown if input power fails again.

If the Auto Restart function is disabled, you can restart the UPS manually by pressing the FAULT CLEAR button.

6.6 UPS Reset

The EPO action or the following reasons such as inverter overtemperature, power-off overload, battery overvoltage and excessive switching may result in the UPS power-off. After all appropriate measures have been taken to clear the faults indicated by the alarm message appearing on the LCD, you can carry out the following steps to restore the UPS to normal operation state.

1. Press the FAULT CLEAR button to make the system exit the EPO state.

2. Press the ON button for 2s.

Note
1. The rectifier restarts, and the bypass supplies power to the load. When the rectifier starts, the fault indicator blinks. When the rectifier runs in normal operation state (about 30 seconds later), the fault indicator will turn off. 2. 5 minutes after the overtemperature signal disappears, that is, when the overtemperature fault is eliminated, the rectifier will automatically start. 3. After the EPO button is pressed, if the mains input is disconnected, the UPS will shut down completely. When the mains input is available, the UPS will start and run in Bypass mode, and also the output is available.

6.7 Language Selection

The LCD menus are available in 17 languages: English, German, Italian, French, Spanish, Portuguese, Chinese, Japanese, Swedish, Russian, Polish, Czech, Turkish, Arabic, Dutch, Finnish and Norwegian.

Procedures for selecting the language:

1. From the ‘Output’ menu, press F3 or F4 (left or right arrow) to select the ‘Language’ menu.

2. Press F5 (Enter) to move the cursor to the data window of the LCD.

3. Use F3 and F4 (up and down arrow) to select the required language.

4. Press F5 (Enter) to confirm.

5. Return to the ‘Output’ menu by repeatedly pressing F2 (ESC). At this point, all texts on the LCD will be displayed in the selected language.

6.8 Changing Current Date And Time

Procedures for changing the system date and time:

1. From the ‘Output’ menu, press F3 or F4 (left or right arrow) to select the ‘Settings’ menu.

2. Press F5 (Enter) to move the cursor to the data window of the LCD.

3. Use F3 and F4 (up and down arrows) to select ‘Date & time’ option, then press F5 (Enter).

4. Move the cursor to the row in which the date and time are displayed, then press F5 (Enter).

5. Use F3 or F4 (up or down arrows), and enter the current time and date information.

6. Press F5 (Enter) to confirm, and then press F2 (ESC) to return to the ‘Output’ menu.

6.9 Control Password

The system provides the password protection for the UPS operation control. The default password of the background software is ‘12345’. Only through the password verification can you conduct the UPS and battery test operation.

Chapter 7 Communication

This chapter briefly introduces the UPS communication.

The communication ports include: Intellislot cards port, opto-coupled port, dry contact port and USB port.

7.1 Installing Intellislot cards

7.1.1 Intellislot card Port

UPS provides an Intellislot card port (see Figure 7-1), which is used to install the communication device options, including global connectivity cards and LIFE.net adapter. The Intellislot card port and USB port can be used at the same time.

Figure 7-1 Intellislot card installation

Refer to *UPS Extended Dry Contact Card User Manual* for the installation and operation guide.

7.2 Connection cables for dry contact port and opto-coupled port

The UPS provides two dry contact ports and three opto-coupled ports; see Figure 1-3 for the specific positions. The silk prints of the five ports are 1, 2, 3, 4 and 5. The pin layout of each port is shown in Figure 7-2, and the port description is shown in Figure 7-1. Cable cross-sectional are 0,1-1,5mm^2.

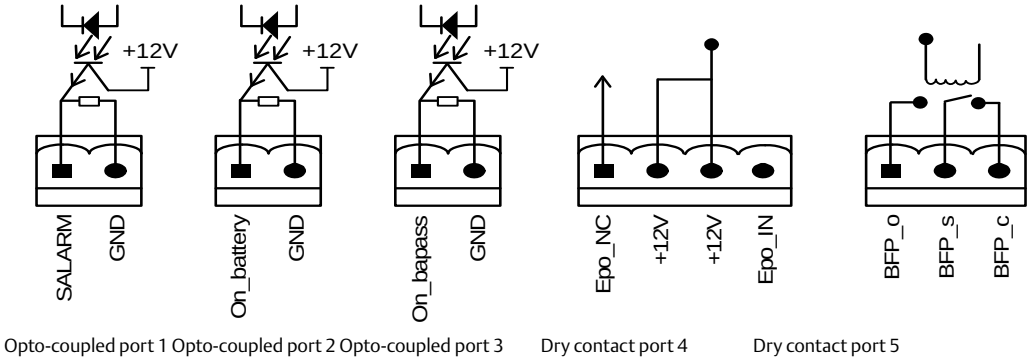


Figure 7-2 Pin layout of dry contact and opto-coupled ports

Port n.	Description	Signal type	Who supply the power of signal	Rated voltage	Rated current
1	Output port of alarm	output	NXC port 1	12V DC	10mA
2	Output port of battery status	output	NXC port 2	12V DC	10mA
3	Output port of bypass status	output	NXC port 3	12V DC	10mA

Port n.	Description	Signal type	Who supply the power of signal	Rated voltage	Maximal resistance of EPO_NO	Maximal resistance of EPO_NC
4	Input port of remote EPO	input	NXC port 4	12V DC	10Ohm	10Ohm

Port n.	Description	Signal type	Who supply the power of signal	Rated voltage and current for NO contact	Rated voltage and current for NC contact
5	Output port of bypass backfeed	output	External	5A 250V AC/24V DC	

Description of the dry contact ports

Silk print	Port name	Pin NO.	Pin name	Meaning
1	Output port of alarm	1.1	S_ALARM	The signal level is 12V when the system alarms
		1.2	GND	GND
2	Output port of battery status	2.1	ON_BATTERY	The signal level is 12V when the system runs in battery mode
		2.2	GND	GND
3	Output port of bypass status	3.1	ON_BYPASS	The level is 12V when the system runs in bypass mode
		3.2	GND	GND
4	Input port of remote EPO*	4.1	EPO_NC	EPO activated when opened to 4.2
		4.2	+12V	EPO activated when opened to 4.1
		4.3	+12V	EPO activated when shorted to 4.4
		4.4	EPO_IN	EPO activated when shorted to 4.3
5	Output port of bypass backfeed	5.1	BFP_O	Bypass backfeed protection relay (normally open). Closes when short circuit of bypass silicon controlled rectifier (SCR) leads to backfeed
		5.2	BFP_S	The middle point of the bypass backfeed protection relay
		5.3	BFP_C	Bypass backfeed protection relay (normally open). Opens when short circuit of bypass SCR leads to backfeed

Note*:
Pin1 and pin2, or pin3 and pin4 of the dry contact port 4 reserves the corresponding terminals for configuring the REPO function. The REPO device also needs the shielded cable to connect to the normally open/closed remote REPO switch between the two terminals. If not necessary, you should disconnect pin3 and pin4 of the dry contact port 4, or short pin1 and pin2 of the dry contact port 4. Pin1 and pin2 of the dry contact port 4 have been shorted before delivery

Note

The EPO action of the UPS will stop the rectifier, inverter and static bypass, but it cannot disconnect the UPS mains input inside. If you want to disconnect the UPS completely, just disconnect the upstream input MCB when generating the EPO.

In emergency conditions, close the REPO switch (prepared by users) to shut down the rectifier and inverter, and the UPS is powered off. In normal condition, the REPO switch cannot cut off the UPS input power. If a switch of electronic control tripping function is adopted at the UPS input, the REPO switch can help the switch trip and thus cut off the UPS input power. The position of the REPO switch is shown in Figure 1-3, and the REPO cable connection is shown in Figure 7-3.

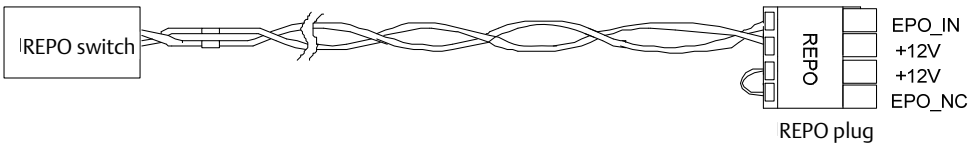


Figure 7-3 REPO cable connection

The cable connection procedures are as follows:

1. Loosen the “+12V” and “EPO_IN” connection terminals of the REPO port.

2. Insert the two ends of the copper core cables with the insulation stripped back into the “+12V” and “EPO_IN” connection terminals of the REPO port, and press down the terminals. The REPO cable is complete. Ensure that the REPO cable is firmly connected to avoid no action or wrong action of the REPO caused by accidental dropping or rough handling.

3. For parallel UPS, when connecting the REPO cable, users should parallel connect “+12V” of the REPO port with one end of the electronic switch, and parallel connect “EPO_IN” with the other end of the electronic switch. Note the difference between the port silkscreen “+” and “-” during connection.

When the REPO switch at the user end closes, the UPS will generate an alarm and cut off the output immediately, and the UPS will not return to the normal operation state automatically. At this point, you must change the REPO switch state, and power on the UPS manually.

Note
1. It is recommended to use 0.82mm^2 ~ 0.33mm^2 (signal cable of 18AWG ~ 33AWG) copper core cable. 2. If the switch you have configured is of electronic control tripping function, when the REPO signal takes action, you need to close the switch before restart the UPS.

7.3 Connecting USB Communication Cables

The USB port is located on the rear panel of the UPS, as shown in Figure 1-3.

The USB port can connect the monitoring software.

The methods to connect the communication cable are as follows:

Insert one end of the USB communication cable to the USB port (see Figure 1-3) on the rear panel of the UPS, and connect the other end to the USB port of the computer.

After the connection, you need to install the USB drive program in the installation disk.

Chapter 8 Maintenance

This chapter focuses on the UPS maintenance, including the fan maintenance, battery maintenance, UPS cleaning, UPS state check, UPS function check.

8.1 Fan Maintenance

The UPS fans are expected to run for 20000 hours ~ 40000 hours continuously. The higher the ambient temperature, the shorter the fan life is.

During the UPS operation, please verify the fan status once every half year by confirming that air blows out from the ventilation holes on the rear panel.

8.2 Battery Maintenance

Note
1. Never reverse-connect the battery, otherwise the fire will occur. 2. Never open the battery to prevent physical injury because of the electrolyte. If you accidentally touch the electrolyte, wash the area immediately with plenty of clean water and go to hospital.

The internal battery module of the UPS is sealed, lead-acid, maintenance-free battery. The battery life depends on the ambient temperature, charge and discharge times. High ambient temperature and deep discharge shortens the battery life.

To ensure the battery life, it is required to:

- Keep the ambient temperature ranging from 15°C to 25°C.
- Prevent small current discharge. Continuous battery operation time exceeding 24 hours is strictly prohibited.
- Charge the battery for at least 12 hours, if the battery hasn't been charged for three months at specified ambient temperature, or two months at high ambient temperature.

Note
1. Make sure that the safety equipment are complete and that the function is normal, especially that the settings of the battery management parameters are normal. 2. Measure and record the internal temperature of the battery room. 3. Check whether the battery terminals are damaged or hot, and whether the cases and the covers are damaged.

If liquid leakage and damage to the battery are found, place the battery in the anti-vitriol tank, and deal with it according to the local regulations.

The waste lead-acid battery is dangerous waste material. It is one of the national emphases to control the waste battery pollution. Its storage, transportation, usage and disposal must follow the national and local law and other criterions about the dangerous waste material and the waste battery pollution prevention.

According to the related regulations, recycle the waste lead-aid battery, and other disposal methods are prohibited. Throwing away randomly the waste lead-aid battery and other improper disposal methods can result in serious environment pollution, which will be investigated the legal responsibility.

As the provider of the lead-acid battery, Emerson has built perfect service network and recycle system for the waste battery to assist users to deal with the waste battery by law. Contact Emerson or the nearest service center for the detailed information of the recycle system about the waste battery.

Emerson is not liable for the environment results caused by failure to comply with the notices in this section or to use the waste battery recycle system provided by Emerson.

8.3 Cleaning UPS

Clean the UPS periodically, especially the ventilation holes, to ensure free airflow inside the UPS. If necessary, clean the UPS with a vacuum cleaner. Confirm that the ventilation holes are unobstructed.

8.4 Checking UPS State

It is recommended to check the UPS operation status once every half year.

Check the following items:

1. Check if the UPS is faulty: Is the FAULT indicator on? Is the UPS giving any alarm?

2. Check if the UPS is operating in Bypass mode. Normally, the UPS operates in Normal mode; if it is operating in Bypass mode, you should find out the reason, such as operator intervention, overload, internal fault, and so on.

3. Check if the battery is discharging: When AC mains is normal, the battery should not discharge; if the UPS operates in Battery mode, you should find out the reason, such as mains failure, battery test, operator intervention, and so on.

8.5 Checking UPS Functions

Note
UPS functional check procedures may cause power interruption to load!

It is recommended to check the UPS functions once every half year.

Backup the load data before conducting the UPS functional check. Procedures are as follows:

1. Press the OFF button to check if the buzzer beeps, indicators are on and the LCD display is normal.

2. Press the ALARM CLEAR button to check again if the indicators are on, the LCD display is normal and the UPS has been transferred to the inverter mode.

Chapter 9 Product Specifications

The chapter lists the UPS specifications.

9.1 Conformity and Standards

The UPS has been designed to conform to the European and international standards listed in Table 9-1.

Table 9-1 European and International Standards

Item	Normative reference
General and safety requirements for UPS	EN/IEC 62040-1
EMC requirements for UPS	EN/IEC 62040-2 (category C2)
Note: The product standards in this table incorporate relevant compliance clauses with generic IEC and EN standards for safety (IEC/EN/60950), electromagnetic emission and immunity (IEC/EN/61000 series) and construction (IEC/EN/60146 series and 60529)	

9.2 Environmental Characteristics

Table 9-2 Environmental Characteristics

Item	Unit	Rated power (kVA)		
		10	15	20
Noise within 1 m (from the front)	dBA	<58	<58	<58
Altitude	m	>2000, derating according to GB/T3859.2 when higher that 2000 m		
Relative humidity	%RH	5 -95, non condensing		
Operating temperature	°C	0 to 40; battery life is halved for every 10°C increase above 20°C		
Storage and transport temperature for UPS	°C	-20 to 70		
Recommended battery storage temperature	°C	-20 to 30 (20°C for optimum battery storage)		
Overvoltage level		II		
Pollution level		II		

9.3 Mechanical Characteristics

Table 9-3 Mechanical Characteristics

Item	Unit	Rated power (kVA)		
		10	15	20
Dimensions (W × D × H)	mm	500 x 860 x 1240		
Net / Gross Weight (excluding battery)	kg	115/145		
Net / Gross Weight (one string of battery)	kg	215/245		
Net / Gross Weight (two strings of battery)	kg	315/345		
Net / Gross Weight (three strings of battery)	kg	415/445		
Net / Gross Weight (four strings of battery)	kg	520/550		
Color	-	Black ZP-7021		
Protection degree, IEC (60529)	-	IP20		

9.4 Electrical Characteristics (Input Rectifier)

Table 9-4 Rectifier AC Input (Mains)

Item	Unit	Rated power (kVA)		
		10	15	20
Rated AC input voltage[1]	Vac	380/400/415; default 400		
Frequency[2]	Hz	40...70		
Power factor	kW/kVA, full load; half load	>0.99 @ full load; > 0.98 @ half load		
Input power	kVA rated[3]	10	15	20
	kVA rated[3] (max.[4])	15	20	25
Input current	A rated[3]	14	21	28
	A rated[3] (max.[4])	21	28	35
Harmonic current distortion	THDI% FL	<5 (3/3); <15 (3/1)		
Duration of progressive power walk-in	s	5		

Note:
[1] Rectifier operates at any of the rated supply voltages and frequencies without further adjustment.
[2] At 305 V mains input, the UPS maintains the specified output voltage at rated load without discharging a previously charged battery.
[3] EN/IEC 62040-3/EN50091-3: at rated load and input voltage 400V, battery charged.
[4] EN/IEC 62040-3/EN50091-3: at rated load and input voltage 400V, battery charging at maximum rated power

9.5 Electrical Characteristics (Intermediate DC Circuit)

Table 9-5 Battery

Item	Unit	Rated power (kVA)		
		10	15	20
Battery bus voltage	Vdc	Nominal: 384 (VRLA float charge is 436 V); range: 300 to 576		
Quantity of lead-acid blocks	Nominal	32		
	Other possible values	30-34-36-38-40		
Float voltage	V/cell (VRLA)	2.27 (selectable between 2.2 V/cell and 2.3 V/cell) Constant current and constant voltage charge mode		
Ripple voltage	% V float	□1.41		
Ripple current	% C10	□5		
Boost voltage	V/cell (VRLA)	2.35 (selectable between 2.3 V/cell and 2.4 V/cell) Constant current and constant voltage charge mode Programmable automatic trigger or inhibit of boost mode		
Boost control	-	Float-boost current trigger 0.050 C10 (selectable between 0.001 and 0.070) Boost-float current trigger 0.010 C10 (selectable between 0.001 and 0.025) 24h safety time timeout (selectable between 8h and 30h) Boost mode inhibit also selectable		
EOD voltage	V/cell (VRLA)	Lower limit: 1.63 (selectable between 1.60 V/cell and 1.67 V/cell) Upper limit: 1.75 (selectable between 1.67 V/cell and 1.85 V/cell) Automatic inverse, EOD voltage x discharge current mode (the EOD voltage increases at low discharge currents)		
Max battery charging power[1] and max charging current (adjustable) [2]	kW	4.5		
	A	11		

Note:
[1] At low input voltage the UPS recharge capability increases as the load decreases (up to the maximum capacity indicated).
[2] Max currents listed are for EOD voltage of 1.67 V/cell for 240 cells

9.6 Electrical Characteristics (Inverter Output)

Table 9-6Inverter Output (to Critical Load)

Item		Unit	Rated power (kVA)		
			10	15	20
Rated AC voltage[1]		Vac	3-In 3-Out: 230Vac ±1% 3 phase balanced		
Frequency[2]		Hz	50/60		
Overload	60 min	%	105		
	5 min	%	125		
	1 min	%	150		
	< 200 ms	%	>150		
Fault current		A (RMS)	91A for 200ms		
Non-linear load capability[3]		%	100		
Load crest factor		-	3:1		
Max. neutral current for non-linear load		A (RMS)	50		
Steady state voltage stability		%	±1		
Transient voltage response for 100% rated linear load step		-	±5% within 60ms		
Total harmonic voltage (0-100% load)		%	2% linear load; 5% non linear load		
Synchronization window		%	Rated frequency ±8		
Slew rate (max change rate of synchronization frequency)		Hz/s	0.6 (single UPS), 0.2 (parallel system)		

Note:
[1] Factory set to 400V, 380V or 415V selectable by commissioning engineer.
[2] Factory set to 50Hz, 60Hz selectable by commissioning engineer. Note that the system frequency can be changed only when the UPS is on bypass. It is strictly prohibited to change the system frequency when the UPS is on inverter.
[3] IEC 62040-3, annex E (crest factor 3:1).

9.7 Electrical Characteristics (Bypass Input)

Table 9-7 Bypass Input

Item		Unit	Rated power (kVA)		
			10	15	20
Rated AC voltage[1]		Vac	380/400/415, three-phase five-wire, sharing neutral with the rectifier input and providing neutral reference to the output		
Rated current	380V	A	16	23	30
	400V	A	15	22	29
	415V	A	14	21	28
Current rating of neutral cable		A	87		
Overload	long time	%	105		
	5 min	%	125		
	1 min	%	150		
	1 s	%	400		
	< 200ms	%	>400		
Frequency[2]		Hz	50/60		
Transfer time (between bypass and inverter)		ms	Synchronous <2 ms Asynchronous <20 ms (40, 60, 80, 100, 120 can be set)		
Bypass voltage tolerance		%Vac	Upper limit: +10, +15 or +20; default: +15 Lower limit: -10, -20, -30 or -40; default: -20		
Bypass frequency tolerance		%	±10		
Synchronization window		%	Rated frequency ±8		

Note:
[1] Factory set to 400V, 380V or 415 V selectable by commissioning engineer.
[2] Factory set to 50Hz, 60 Hz selectable by commissioning engineer.

9.8 Efficiency, Heat Losses and Air Exchange

Table 9-8 Efficiency, Heat Losses and Air Exchange

Item		Unit	Rated power (kVA)		
			10	15	20
Overall efficiency					
Normal mode (double-conversion)	100% load	%	94.2	94.1	94.0
	66% load	%	93.9	94.2	94.5
	33% load	%	91.3	93.7	93.9
ECO Mode		%	98		
Battery mode		%	92.5	92.8	93
Heat losses & air exchange					
Normal mode		kW	0.55	0.84	1.15
Eco mode		kW	0.18	0.28	0.37
No load		kW	0.24		
Maximum forced air cooling (front intake, rear exhaust)		L/sec	208		
Note: 400Vac input and output, battery fully charged, full-rated linear load					

Chapter 10 Options

This chapter introduces the options of the UPS.

10.1 Option list

See Table 10-1 for the option list.

Table 10-1 Option list

Option name	Model	Remark
Communication cables	00B46158P77	Liebert® NXC 10/15/20kVA UPS parallel communication cable, LBS Communication cable

10.2 Communication Cables

Communication cable is compulsory in parallel system. See Table 10-2 for cable description. Refer to 4.3.2 for the methods to connect the parallel cables.

Table 10-2 Description of the communication cable

Type	Name	Description	Appearance
00B46158P77	Communiation cable	For N + 1 parallel system, N + 1 communication cables are needed. For example, two communication cables are needed in 1 + 1 parallel system; three communication cables are needed in 2 + 1 parallel system; four communication cables are needed in 3 + 1 parallel system	

10.3 Battery Cabinet

For extra long back up time an external battery cabinet is available.

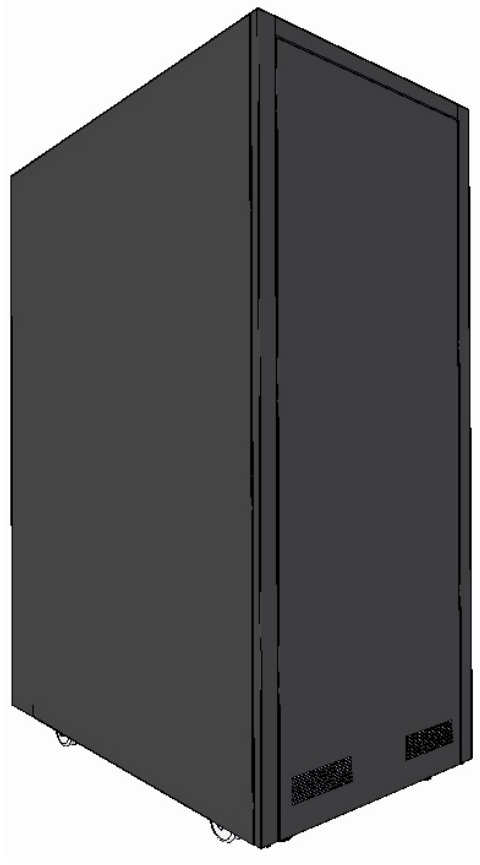


Figure 10-1 Appearance of the battery cabinet

10.4 Liebert NXC Input Transformer Version

This UPS includes an isolation transformer at the UPS input. This transformer is installed in place of the batteries and provides electrical isolation between the load and the input mains utility.

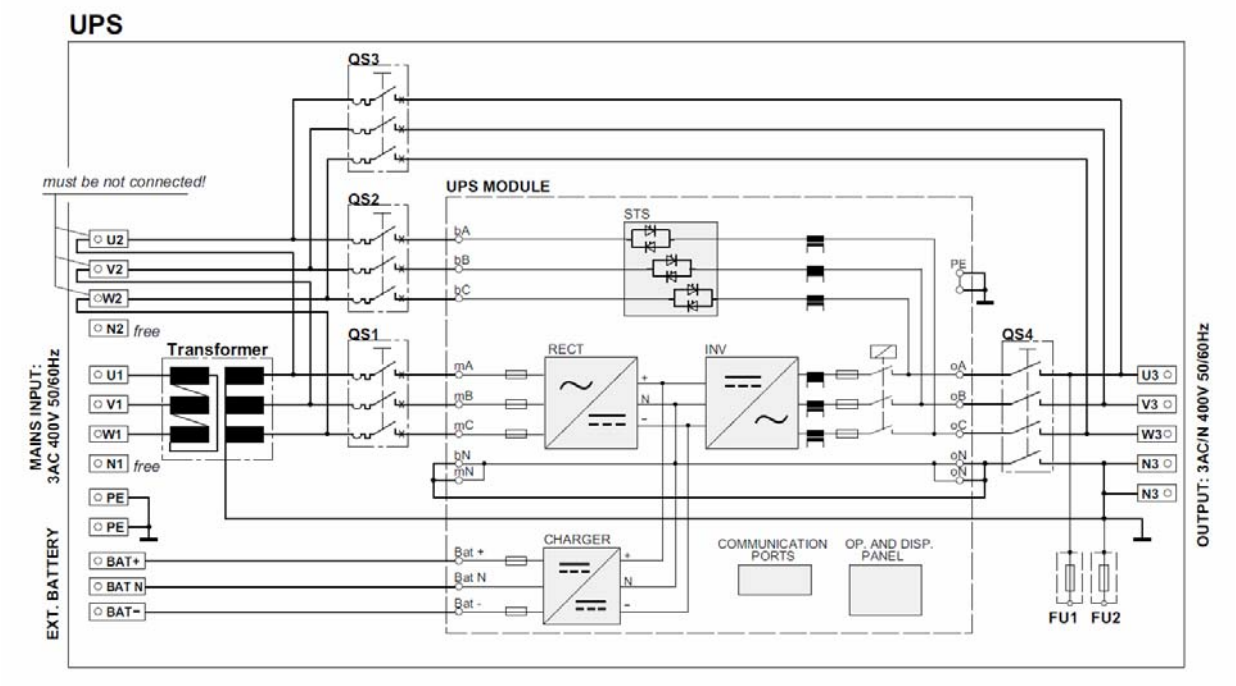
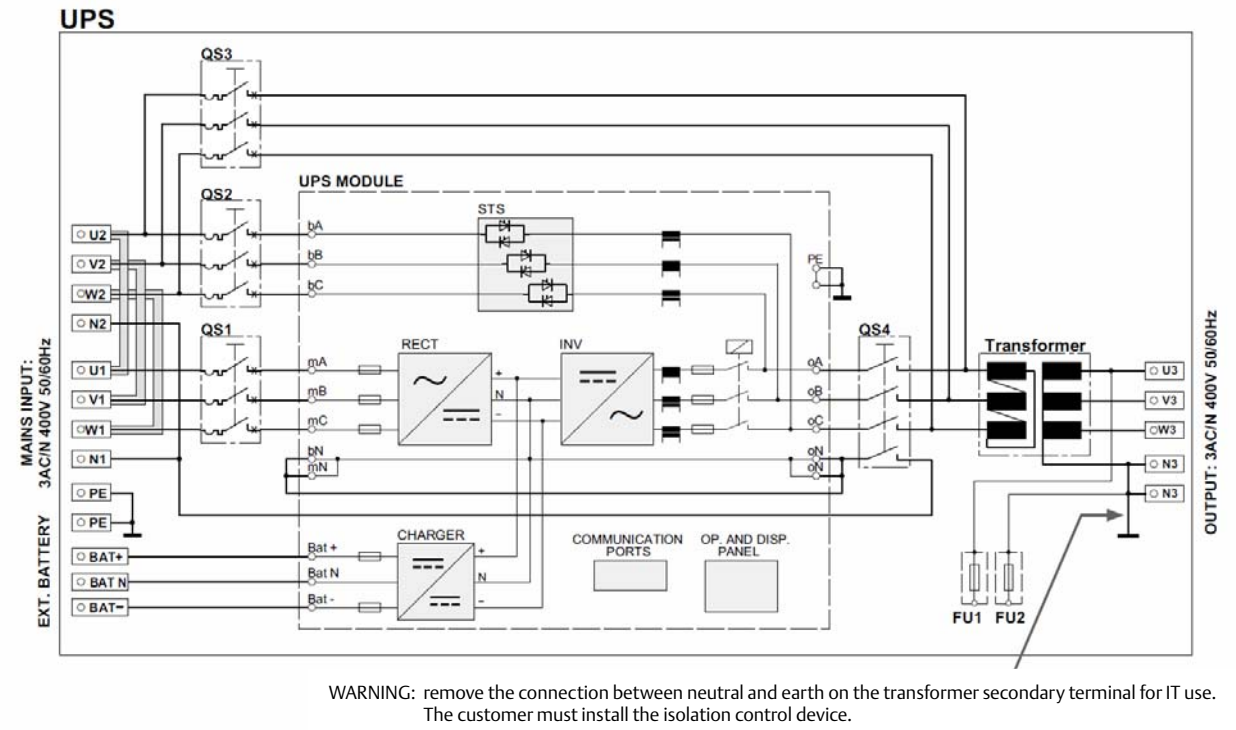


Figure 10-2 UPS with input isolating transformer

10.5 Liebert NXC Output Transformer Version

This UPS includes an isolation transformer at the UPS output. This transformer is installed in place of the batteries and provides electrical isolation between the UPS output and the load.



WARNING: remove the connection between neutral and earth on the transformer secondary terminal for IT use.
The customer must install the isolation control device.

Figure 10-3 UPS with output isolating transformer

Appendix 1 Abbreviations

AC	Alternating current
CSA	Cross sectional area
DC	Direct current
DSP	Digital signal processor
EMC	Electromagnetic compatibility
EOD	End-of-discharge
EPO	Emergency power off
LCD	Liquid crystal display
LBS	Load bus synchronizer
MCB	Miniature circuit breaker
PE	Protective earth
RCCB	Residual current circuit breaker
RCD	Residual current detector
RFI	Radio frequency interference
SCR	Silicon-controlled rectifier
STS	Static transfer switch
UPS	Uninterruptible power system
VRLA	Valve-regulated lead-acid

Appendix 2 Information for the protection of the Environment

This unit makes use of components dangerous for the environment (electronic cards, electronic components and batteries). The components removed must be taken to specialized collection and disposal centers.

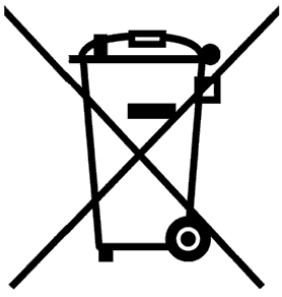
In case of complete unit dismantling, this operation shall be carried out by specialized personnel and the unit must be taken to centers specialized in collection and disposal of dangerous substances.

Part name	Hazardous Substances or Elements Announcement					
	Lead	Mercury	Cadmium	Chrome	PBB	PBDE
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
Hex copper stud	×	o	o	o	o	o
PCBA	×	o	o	o	o	o
AC capacitor	×	o	o	o	o	o
DC capacitor	×	o	o	o	o	o
Fan	×	o	o	o	o	o
Cables	×	o	o	o	o	o
LCD	×	×	o	o	o	o
Sensors	×	o	o	o	o	o
Large-medium power magnetic components	×	o	o	o	o	o
circuit breaker / rotating switch	×	o	o	o	o	o
Semiconductors	×	o	o	o	o	o
Battery (when applicable)	×	o	o	o	o	o
Insulation monitoring device (when applicable)	×	o	o	o	o	×

o: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006
×: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Emerson Network Power Co., Ltd. has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the harzardous substances in the products through unremitting efforts in research.However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:
1. All solders in the products contain lead
2. Copper alloy contains lead
3. Backlight bulb contains Mercury
4. The ceramic materials of the ceramic capacitor, the copper terminals and copper leads of metallic film capacity contain lead.
5. The glass of resistor contains lead.
6. The glass of LCD contains lead, and the backlight lamp contains Mercury.
7. The lead in the battery is determined by the battery feature and technical levels.
8. The insulation monitoring device contains lead and PBDE.

NOTICE TO EUROPEAN UNION CUSTOMERS: DISPOSAL OF OLD APPLIANCES



This product has been supplied from an environmentally aware manufacturer that complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/CE.

The “crossed-out wheelie bin” symbol at right is placed on this product to encourage you to recycle wherever possible. Please be environmentally responsible and recycle this product through your recycling facility at its end of life. Do not dispose of this product as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).

For information regarding the scrapping of this equipment please contact your closest Emerson Representative.

Ensuring The High Availability Of Mission-Critical Data And Applications.

Locations

Emerson Network Power
Via Leonardo Da Vinci 16/18
Zona Industriale Tognana
35028 Piove di Sacco (PD) Italy
Tel: +39 049 9719 111
Fax: +39 049 5841 257
marketing.emea@emersonnetworkpower.com

Via Fornace, 30
40023 Castel Guelfo (BO) Italy
Tel: +39 0542 632 111
Fax: +39 0542 632 120
enquiries.chloride@emerson.com

United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Tel: +1 614 8880246

Asia
7/F, Dah Sing Financial Centre
108 Gloucester Road, Wanchai
Hong Kong
Tel: +852 2572220
Fax: +852 28029250

Emerson Network Power
The global leader in enabling Business-Critical Continuity™.

EmersonNetworkPower.com

- AC Power
- Connectivity
- DC Power
- Embedded Computing
- Embedded Power
- Infrastructure Management & Monitoring
- Outside Plant
- Power Switching & Controls
- Precision Cooling
- Racks & Integrated Cabinets
- Services
- Surge Protection

Emerson, Business-Critical Continuity and Emerson Network Power are trademarks of Emerson Electric Co. or one of its affiliated companies. ©2011 Emerson Electric Co.